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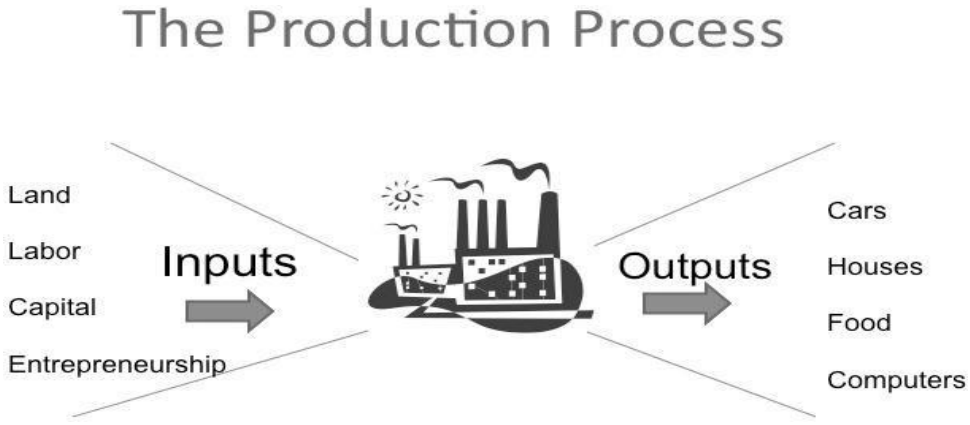
MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY NATIONAL AGRARIAN UNIVERSITY

Public Management and Administration Department

ECONOMICS OF PRODUCTION

COURSE BOOK



Sumy – 2021

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ECONOMICS OF PRODUCTION
COURSE BOOK

for English-Speaking Students
of Economics and Management Faculty, 1st year of study master's degree,
specialty: 073 Management
Educational program "Administrative management"

Sumy – 2021

UDC 658

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Lecture notes for English-speaking Students of Economics and Management Faculty, 1rd year study master's degree, specialty: 073 Management, EP "Administrative management". September, 2021. - 116 p.

Lecture notes for English-speaking students are designed to assist students during study of Economics of production. Contain main theoretical material.

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CONTENT

INTRODUCTION

Economics of production is the important part of agricultural production, because the each element of "production - consumption of agriculture goods" chain is the certain structure unit. Student must be able to estimate the production-technical alternatives of plant growing and animal husbandry, to analyze the results of economy and society development from the economic point of view.

The aim of discipline studying is mastering of deep knowledge from the economy of production, forming the economic thinking for the master's degrees of agrarian complex, enterprise and commercial approach to the productive tasks decision. Discipline is founded on bases of economic theory and teaching methodology satisfied the international requirements. The science knowledge level determines professional training for specialists of agrarian sector of economy and preparedness to practical activity in modern terms.

Content of discipline:

Module 1: Doctrine of economics of production. The bases of production theory.

1.1.Methods of production processes estimation

1.2.Estimation of circulating capital requirement

Module 2: Economics of plant growing industries

2.1. General economic aspects of plant growing

2.2. Production of commodity goods of plant growing

2.3. Feed crop production process

Module 3: Economics of animal husbandry industries

3.1. General economic aspects of animal husbandry goods production

3.2. Dairy cattle breeding

3.3. Breeding and fattening of big horned cattle (pedigree heifers and fattening bulls)

3.4. Pedigree pigs breeding

3.5. Pigs fattening

Results of studies:

Students must know:

Methods of management, essence of productive function and factors;

Classification of expenses and output in an agricultural production;

Classification of agricultural industries and their general economic aspects.

Students must be able:

Module 1: To apply and realize the productive function essence, variable factors, associate, parallel, competitive, contiguous production determinations, founding on the mastered theoretical theses of the module.

Module 2. To realize of productive process determination, founding on the mastered theoretical theses of the module. Be able to calculate the gain of realization.

Module 3. Be able to calculate marginal incomes for each of productive processes, founding on the mastered theoretical theses of the module.

THEME 1. METHODS OF PRODUCTION PROCESSES ESTIMATION

1. Determination of production process
2. Sizes of production processes determination
3. Production processes estimation scales
4. Estimation of production processes efficiency

1. Determination of production process

1.1. Essence of production process

Multilateral interconnections between the separate spheres of agricultural production bring to necessity to considerate an agricultural enterprise as one organic unit. In spite of this, the dividing of production directions of agricultural into more shallow units (1 ha of certain culture, 1 animal etc.) is the important condition of objective production estimation. These units are defined so, that quantities and operations are presented in their least parts, and values more precisely contrast with costs, connected with their production as possible. In this sense a productive process is considered as the least unit of economy. Productive processes are characterized by finish good, and, in addition, to characterize them the next coefficients are used:

Indicators of evaluation of production output *(Output)***.** Productivity - the kind and amount of basic and side goods gained on a 1 unit (1 h, 1 head). Commodity goods are mainly estimated by prices, while uncommodity products are expressed in natural units (side products; e.g. basic forage, straw, manure) as a rule.

Indicators of evaluation of used production resources (*Input*). The kind and amount of needed to produce a 1 unit of goods productive resources are determined in monetary form (costs) or in natural size. The commodity good, being the productive factor is estimated in accordance with its market price (special costs). There are distinguished such forms of special costs as proportionally-variable special costs (e.g. means of plants protection) and disproportionate / permanent (e.g. granary, storages). Permanent costs, depending on calculation aims, often are estimated in natural sizes (productive factors requirement, limited production capacities requirement). If productive factor is the product of the same household, then its requirement will be expressed as natural requirement as a rule.

There are supposing, that separate coefficients change proportionally to production process expansion, as a rule. For example, it means that breeding of 6 dairy cows needs in 3 times more business hours than breeding of 2 cows. If this supposition is not true, it will take into account production process description. The

production process estimation, using coefficients, binds economics and technology of production process. Economic estimation will be significant only if it is based on real information about production process. It is necessary to specify what kind of production-technology suppositions base the separate economic sizes.

1.2. Differentiation of production processes

Many productive processes exist in an economy only in connection with each other (dairy cattle breeding and feed crops production), or use products of other production processes as the productive factors (dairy cattle breeding: young animals are used for fattening of bull-calves). Therefore for differentiation production processes it is necessary to fix the limits among certain processes in its structure. There are some recommendations to make it easily and right:

1) *All indicators must be attributed to the reasons of origin.*

Example: Expenses connected with bringing of organic fertilizers (manure) are attributed to the animal husbandry production processes, but not to the plant growing productive processes, because they change proportionally of animal husbandry processes volume. Consequently, the value of the got organic fertilizers may be presented as the certain animal making.

2) *If commodity goods are used as the semi-finished products in own household, so determining of production process limits we should take into account typical for this product market qualities, to use the Franco-household price for estimation.*

Example: Bull-calves that are grown in a household and are fattening up here, for dairy cattle breeding production process are presented as output but at the same time for bull-calves fattening process they are the expense factor. As a border of production processes (point of dividing) we can use the age of bull-calves realization, because it is possible to determinate the actual price in this period the most exactly. All expenses, connected with young animals breeding to this period, can be attributed to the dairy cattle breeding process, all other expenses are attributed to the bull-calves fattening production process.

3) *It is necessary to secure the comparison of production processes. It is necessary that the compared to each other production processes have the same limits (points of dividing) relatively other productive processes.*

Example: The dairy cattle breeding process connects with different feed crops production processes (basic forage, silage, hay). To determine preferable process all processes must have the same borders relatively the dairy cattle breeding. If expenses of feed crops production are considered only to the certain forage storehouse and expenses of fattening are attributed to dairy cattle breeding, so objective comparison

won't be guaranteed. If the feed distributor is chosen as a border of processes, so such border will be more appropriate to compare the production processes.

2. Sizes of production processes determination

2.1. Sizes of output determination.

The gain of realization. The gain of realization of product depends on volume of basic and side product realization and proper prices. It is necessary to take into account that basic and side products will be estimated founding on proper market prices, even if it is not meant for sale. For example, the gain of realization of wheat growing production process is equal to product of harvest and actual market price, independently from aim of wheat using (for sale or intra-household usage). If the wheat production replaces its purchase, so the value of purchasing will be the actual.

Example:

Productivity – 60 c/ha

Price – uah/c

Gain of realization = 60*25= 1500 uah/ha

Estimation of different quality products. If produced products of different quality (e.g. at the high-quality wheat production process the part of harvest, in accordance with standards, is a feed wheat), then it will be necessary to calculate an average price, or to take stock of different part of harvest in accordance with the quality of product and proper actual prices. The latter is more comfortable for calculation and analyzing.

Seasonal differentiation of prices. Prices on agrarian products can fluctuate depending on season. Therefore, it is necessary to divide the production processes depending on the periods of products realization. If the production process is periodic or production periods are permanent set depending on the regional climate features, so the price's fluctuations will be taken into account in average prices calculation.

Estimation of interchangeable products. Interchangeable commodity goods are estimated basing on household prices. Sometimes there is a necessity of determination of replacement value for uncommodity goods. Using of purchasing price for an estimation can be really faithful only in exceptional cases, when a certain product in default of its own production is really acquired at too high price (on that selling is impossible).

Production of half-finished products. Half-finished products are all the products not taken stock of the gain of realization calculation – uncommodity goods (straw, basic forage, silage, hay, liquid manure etc.). Estimation of half-finished

products by market price is almost impossible, they are estimated in natural sizes (60 c of straw from 1 ha of areas under wheat etc.)

The estimation of the gain of realization or half-finished products. Sometimes in practice it is advantageously:

а) to estimate a half-finished products basing on replacement value or output value, considering it as the gain of realization (for example, got from stock-raising processes organic fertilizers and side products of plant growing often are estimated basing on relative prices of feeding purchase and value of organic substances replacement).

б) to consider the commodity goods through the alternatives of the household using as half-finished products (for example, wheat can be sold or used as forage for pigs). For this case crop capacity can be expressed as half-finished products in natural sizes.

Decision about dividing value into half-finished products or gain of realization depends on the ratio of commodity of output and also on the possibility of its intra-household using. To avoid the double calculation it is necessary to consider that one product can be taken stock of only as a half-finished product or as a commodity product. If there are some identical production processes, so planning them we will consider one depending on half-finished products approach and another, basing on the gain of realization calculation.

2.2 Sizes of production means usage determination (Input)

In practical calculation the costs, depending on their relatively (1 group) or dependence from volume of production (2 groups) are divided into:

1) Direct or indirect expenses;

2) Fixed or variable costs;

It is the most important to estimate the proportionally-variable direct costs, because they can be attributed for certain production process and change proportionally to production expansion. They present marginal costs of certain production process expansion.

Proportionally-variable direct costs. Typical examples of these costs:

1) In plant growing industries there are costs, related with: seeds /seedlings (own production or purchased), fertilizers, means of plants protection, mechanization (variable costs of own technique or mechanization services payment), drying, storage, realization and others.

2) In animal husbandry industries there are the next typical examples of expenses: repair of basic herd (also using the own young animals), purchased forages,

veterinarian and medicines, expenses on coupling and insemination, water, electricity, heating, insurance, realization, variable costs of mechanization etc.

There are some expenses, which, basing on expenses systematization also attributed to (proportionally) variable costs: expenses of the used living and circulating means; expenses of the seasonal special labour force usage; alternative expenses of labour, land, building usage etc.

In practice these expenses often are leaved out of account in marginal calculation. The reasons of this are quoted below.

Expenses of the used living and circulating assets include expenses for using invested into the live and circulating assets capital. Live and circulating means don't amortize: circulating means used during one production period, invested into circulating means capital completely returns after sale or another use of products. So these expenses present themselves recoupment of invested into production capital. They include: expenses of own capital usage – percent rate (%); expenses of loan capital usage – percent.

In practice expenses of the capital usage will be considered in marginal calculation as the costs if the marginal income is used for economic comparison (to choose the optimal production process). If the marginal calculation is done for reductive planning, then the expenses of capital usage will be considered only to calculate production efficiency. If there is a necessity to calculate the expenses of capital usage for certain production process, we will use an approximate percent rate.

Expenses of the seasonal special labour force usage are not considered in the marginal calculation of certain production process as named before. That's why there is important to not consider these expenses as proportionally-variable direct costs of certain production process, but to express the general requirement of labour force using natural sizes. The requirement of seasonal labour force (and proper expenses) are determined only at the household level. The division of expenses into fixed paid and not paid domestic labour force is quoted below.

Disproportional and fixed direct costs. Disproportional variable and fixed direct costs though may be related to the certain production process, change disproportionally to production volume. This group of expenses relates with usage of: special machines, storehouses for certain products or production assets (granary, pit for silage), building for certain products preparation (production of seminal potato) and salary of the permanent special workers, which have long-term labour contracts.

The division of expenses into the variable and fixed costs depends on the production process provision of production assets and planning period duration (figure 1).

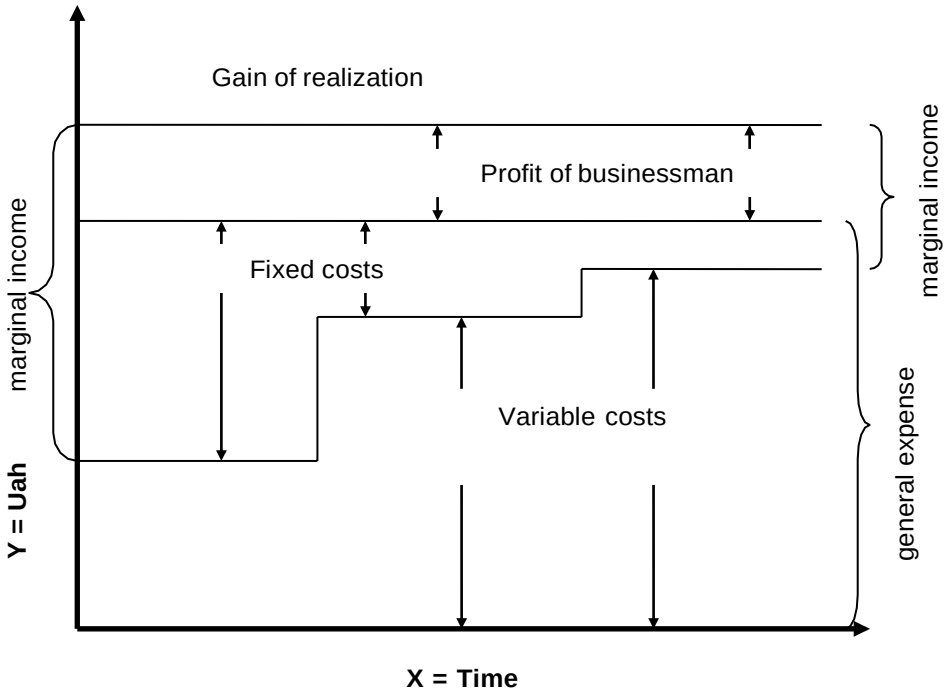


Fig.1. The variable costs and marginal income dependence of planning period duration

Than longer duration of planning period is, the more fixed costs will become variable, because they will get into the period of planner's making decision about. For example, if it is necessary to make decision about the increase of milky cattle population at available production capacities (building, technique), then in short-term there will be considered only current expenses (expenses of basic herd repair, feeding, veterinarian etc.), the expenses of building and technique usage won't change. At the medium-term planning it is necessary to take into account that milking technique needs updating after usage during the two production periods. These expenses (an updating of milking technique) make production less competitive, so they must be considered as variable costs. So than longer planning period, the more fixed costs will become variable. At last, all fixed costs will be considered as variable (very long-term planning period). The same situation will come on if the enterprise plans to expand the production over the production capacities. If household to expand the production needs to purchase the additional areas, technique, buildings, then expenses, related with purchase will be considered as variable in marginal calculation.

If these additional capacities are not purchased, but release on account of another production processes, then alternative expenses will come on. This is due to the fact that the less profitably production process, from the economic point of view, are limited first of all (Figure 2).

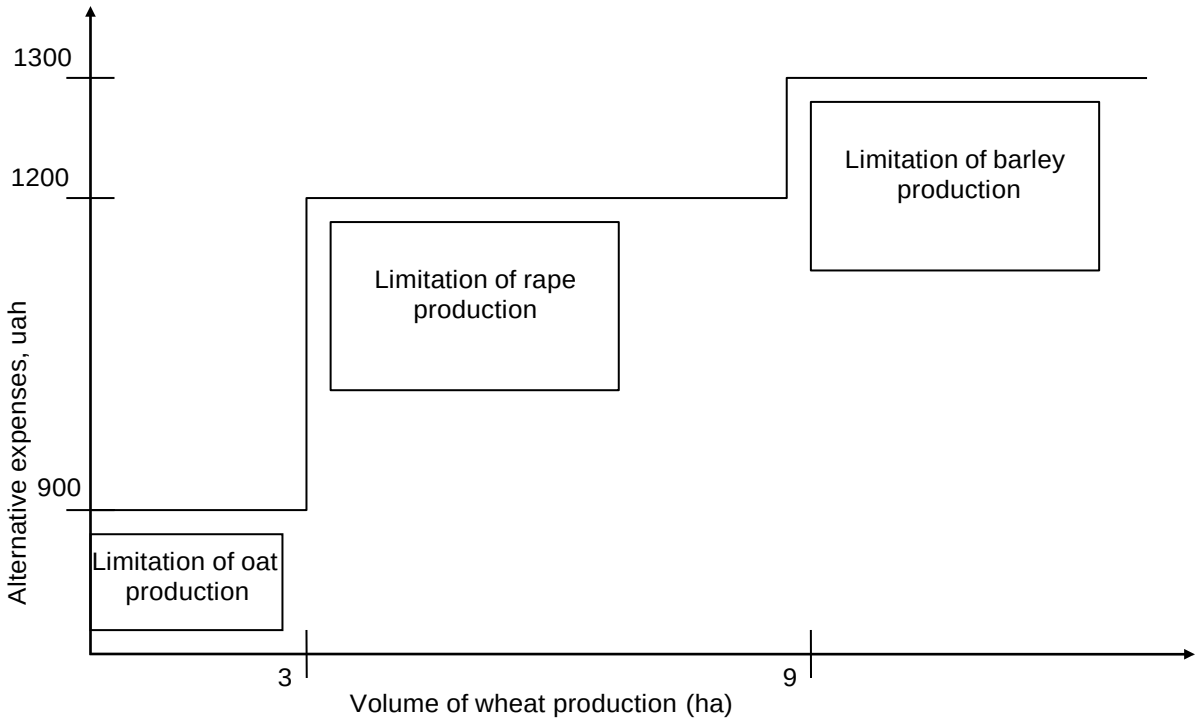


Fig. 2. Dependence of alternative expenses on production expansion

Indirect costs. Indirect costs (overhead costs) can't be attributed to certain production process exactly. They contain expenses of building and machines usage, used by a few (all) production processes, salary of workers executing the not special works, and also administrative costs. All production process contains these expenses. There are different methods to take stock of the indirect costs calculating the lower price limit.

Requirements in production for domestic needs. Requirement in production for domestic needs is calculated only once: during the calculation of proportional indirect costs or (in the monetary form) or during the determination of requirement in production for domestic needs for other production processes (in natural sizes). In simplified calculations it is allowed to express the product for the domestic consumption of a certain production process by the cost of replacing it and adding it to the gain of realization. So marginal income will be calculated in its actual size until the domestic consumption of products is possible. This method is often used to estimate the organic fertilizers in stock-raising production processes. Estimated feeding substances are considered at the same size as proportional expenses in the plant growing production processes (in the general requirement of feeding substances). It will be actually only even organic fertilizers replace mineral.

The fixed assets requirement (factors requirement). Such production factors as soil, labour force, machines and building, using the reductive planning approach, are considered as fixed expenses as a rule. In marginal calculation, using the program planning methods, there is the necessity to determine what production factors are requirement (fixed or variable), depending on the level of production process expansion and duration of planning period.

For example, the requirement of places for cattle will be considered as fixed production factors requirement, if it doesn't exceed the limits of actual availability. If there is wrong, it will be necessary to consider these expenses as variable in another marginal calculation.

Requirement of areas under the crops. The certain plant growing production process requirement of areas depends on vegetative period of culture. If there is possible only the one usage of area during the year, so requirement of areas during the year will be equal 1 ha. If the usage of areas during the year is repeated, so it will be necessary to determine the areas requirement depending on duration of growing period. The soils of different quality must be considered differently.

Requirement of working time. The determination of working time requirement often includes determination of working operations and strained working periods. Such approach gives the ability to determine strained working periods and proper requirement of working force therefore.

Requirement of machines.

The expansion of production needs to compare the present quantity and load of machines and required. So the production expansion may need to purchase the additional machines.

Building and construction requirement. The buildings limit the production development rarely. Only special buildings such as forage storehouses and stock-raising farms may limit the production expansion.

Limits of crop rotation. Limits of crop rotation are determined for each culture independently. For example, areas under ungrain-crops must not be over than 1/3 of the whole areas under crops.

2. Production processes estimation scales

Productivity. The productivity is the benefit of production assets usage. Different production factors used in the production process can't be summarized in their natural expressions. That's why quantity of output is attributed always to one factor among all used in the production (the partial productivity). The productivity of

certain factor is measured in natural sizes firstly. There are such forms of productivity:

- The soil productivity – the crop capacity of 1 ha (60 c from 1 ha);
- The labour productivity – Productivity of 1 human for hour (4 c of wheat for 1 human of hour)
- The productivity of capital – Productiveness of fixed, live, circulating assets unit (6 kg of milk from 1 cow in hour).

If there is the production of basic and side products, it will be necessary to estimate productivity in monetary form (not natural) for exact estimation.

Intensity. The intensity is the quantity of certain production factor usage relatively another productive factor (ratio of production factors). The intensity may be estimated in natural and monetary sizes. The production is divided into intensive and extensive depending on quantity of certain factor usage.

Examples:

Intensity of labour: 8 human in hour for 1 ha grain-growing in a year.

Intensity of capital: 190 uah on 100 ha of areas.

We can highlight the factors of intensity rise, such as fertilizers, means of plants protection or special forages. So, production processes will be named intensive if the usage of factors of intensity rise is the high.

Special intensity relates on the influence of different levels of usage of certain production factor to the harvest, gain and profit within the fixed level of another factors usage.

Profitability. Profitability is the economic benefit of production in monetary expression. It is important to determine calculation of income-costs related to the estimation period and calculation of values-expenses related to object estimation.

The calculation of income and costs related to the period of estimation is made at the enterprise or economy level. Such method is not perfect, because, for example, the grain-crops gathered in the harvest this year were sowed, fertilized and cultivated last year, so the correlation between income and costs is not clear. The calculation of values-expenses related to the object of estimation gives the ability to determine the correlation between expense and related to it value of certain object. This calculation doesn't depend on the duration of estimation period. So there is the ideal approach to estimate the profitability of production process.

Indicator	Action					
The gain of realization incl. estimated half-finished products	+			+	+	+
Proportional variable costs	-	+	+	-	-	-
Marginal income (Practical approach)	=					
Value of side products						
For example, value of calf		-	-			
For example, value of fertilizers		-	-			
For example, straw, forage		-	-			
Other proportional variable costs						
Expenses of basic forage, if given		+	+	-	-	-
Expenses of living and circulating capital usage		+	+	-	-	
The threshold of production I		=				
Labour expenses						
Salary (incl. additional expenses)		+	+			
Rate of salary for unpaid work force		+	+			
Threshold of production II		=				
Alternative expenses of factors usage and rights			*	*	*	*
For example, areas		+	+		-	-
For example, buildings (farm, storehouse)		+	+	-	-	-
For example, delivery's rights		+	+	-	-	-
Threshold of production III		=				
Fixed expenses of factors usage and rights			*	*	*	*
Amortization			+	-	-	-
Keeping			+	-	-	-
Expenses of basic capital usage			+	-	-	
Partial indirect expenses						
For example, general insurance etc.			+	-	-	-
For example, administrative expenses			+	-	-	-
Threshold of profitability / threshold of profit			=			
Recoupment of areas				=		
Recoupment of labour					=	
Percents of all capital						=

Fig. 3. Calculation of production process profitability indices

The important indices of profitability are:

- Threshold of profitability (threshold of profit)

- Threshold of production
- Marginal income
- Recoupment of production factors

The senses of these indices and methods of calculating are given on the figure 3.

4. Estimation of production processes efficiency

4.1 Threshold of profitability (threshold of profit)

A production process will be profitable if the used production factors (own and borrowed) are recompensed. It will take place if value of certain production process is more than its costs. It means that the expenses of one unit of goods production are less than its price of realization. ***The price that is over then all expenses is named threshold of profitability.*** If the price is more than threshold of profitability, then the profit will come on. That's why the threshold of profitability often is named the threshold of profit. This term often is replaced by term "long-term lower price limit", although partial indirect costs are not always taken into account here.

The estimation of threshold of profitability requires the complete attributing of expenses to the carrier of expenses (calculation of complete expenses). In practice all expenses (within alternative expenses), related to the production of certain goods, are accounted for the unit of products and compared with it price. Thus, the threshold of profit will be considered attained, if the product price is equal to the expenses of unit of goods production. If a price exceeds production expenses, then their difference will be an enterprise profit. The next positions are taken into account calculating of complete expenses:

Variable direct costs. There are expenses of factors of turnover means (consumable blessing, advanced expenses) and also purchased (paid) productive factors: salary, living and circulating capital rates, rent (for the fixed assets etc.)

Payments for the own (unpaid) production factors: rate of salary, living and circulating capital rates, and also alternative expenses of areas under crops and fixed assets usage,

Fixed direct costs: amortization, maintenance, percents or rate on the fixed assets (building, construction, technique).

Shared indirect costs of household, variable and fixed costs that can't be attributed to the certain production process (insurances of production in general, payments, salary and expenses of short-term and long-term production assets). The attributing the indirect costs to the certain production processes must be done in accordance with algorithm. If there is a possibility of the alternative usage of fixed

assets (sale), so it will be necessary to choose between the two types of expenses (fixed and alternative) the higher. If the examined expenses attribute to the few types of products production (attended production), then it will be impossible to attribute them to one type of goods. Milky cow for example, produces not only milk, and also young animals and beef. Therefore determination of the single expenses of milk production requires reducing general expenses on the value of side products. This method though is applicable in practice, has the defects, because the value of side products is set on the bases of expenses of side products production. So, the value of side productions is not actual market price and this method is approximate.

The dividing of expenses on side products exactly is not possible as a rule. A decision for this case is consideration of basic and side products in one 'package', as it, for example, takes place at calculation of marginal income. In the diversified economy it is necessary to fail of the attributing the indirect costs to separate production processes during the estimation of profitability. The next problem arises up in connection with alternative expenses for own factors: their size is difficult to determination, because it depends on a volume of production (figure 2). Therefore their exact determination requires consideration of these expenses at general economy level (for example economy planning on a base of marginal calculation). The calculation of expenses for 1 unit of goods is approximate in conditions of diversified economy.

4.2. Threshold of production

The calculation of threshold of production, as well as calculation of threshold of profitability presents itself the calculation of expenses that takes into account only expenses related to the production (calculation of partial expenses on marginal principle). In this connection the value of results increases. It consists foremost in that (at least medium- and long-term) profitability of certain production depends not on complete expenses, but on variables. It takes place because the part of complete expenses exists independently of production process realization and so doesn't influence on decision making. The threshold of production marks a point where marginal value of certain product exceeds the maximum expenses of its production. So the marginal profit finds the maximum size. It means that marginal expenses of product are less than its price. Thus, a threshold of production is the lower limit of production price.

4.3. Marginal income

Methodology of marginal calculation is based on the principle of marginal value. It takes into account an output and usage of production assets (Input). Her primary purpose is determination of intrahousehold competition scale for productive processes at making decision in planning. There are some approaches to calculate marginal sizes (see a fig. 6).

Methodologically actual marginal income. Methodically actual marginal income is the difference between the marginal value and marginal costs. In regard to a separate productive process there are next questions:

The determination of methodically actual marginal income consists in estimation of commodity goods mainly (gain of realization). The half-finished products are estimated in natural sizes and not summarized with the gain of realization. So, the requirements of other production processes also are considered in physical sizes. The gain of realization of certain production process is formed by the values of basic and side products. The marginal costs of fixed and so that limited factors are took into account only in optimization planning of production process (alternative costs).

The marginal income is calculated the next way:

The gain of realization (half-finished products are not considered in monetary form) – Variable costs (as proportional so fixed) = Marginal Income

So, the marginal income presents itself as

a) the contribution in the payment of expenses of fixed production factors:

Areas: the rent of arable land and meadows;

Labour: salary of fixed (all) workers;

Capital: amortization, keeping, percent, rent of building usage, technique, delivery rights and loans.

b) the contribution into the gain of realization forming and payment for own "unpaid" production factors

Capital: percents on the own capital (the own areas);

Labour: the rate of unpaid labour force (domestic) salary;

Management: the payment for the employer's activity of the head of household.

Factors will be considered as fixed only if they are not variable in specific situation.

So, the marginal income shows the contribution of certain production process into the production factors recoupment (see fig. 3, 4) and is the scale of the optimal production process determination.

The most preferable process is that process which ensures the highest recoupment of limited factor. So the competiveness scale is formed by factor recoupment:

$$\textit{Marginal income per unit Recoupment of factor} = \frac{}{\textit{Factor's requirement per unit}}$$

Example: Marginal income per 1 ha of areas, per 1 human for hour, per 1000 uah of circulating capital (if the capital is considered as fixed factor) etc.

If the planning period becomes longer, so more costs will become variable and marginal income will fall. (see fig.1). The marginal income can't be use as a scale for comparison between industries, because the provisions of production factors in various households are different.

For example: The grain household is completely provided by own technique and all works are implemented by the own workers. The another household uses the sowing technique services to cultivate all areas under crops, and the next household uses the sowing technique services to cultivate the most part of areas under crops. Marginal incomes of these households are contrasted with different factors provisions and levels of fixed costs.

That's why marginal income is the only intra-household profitability scale.

Another approach called standard marginal income can be used to compare the various households.

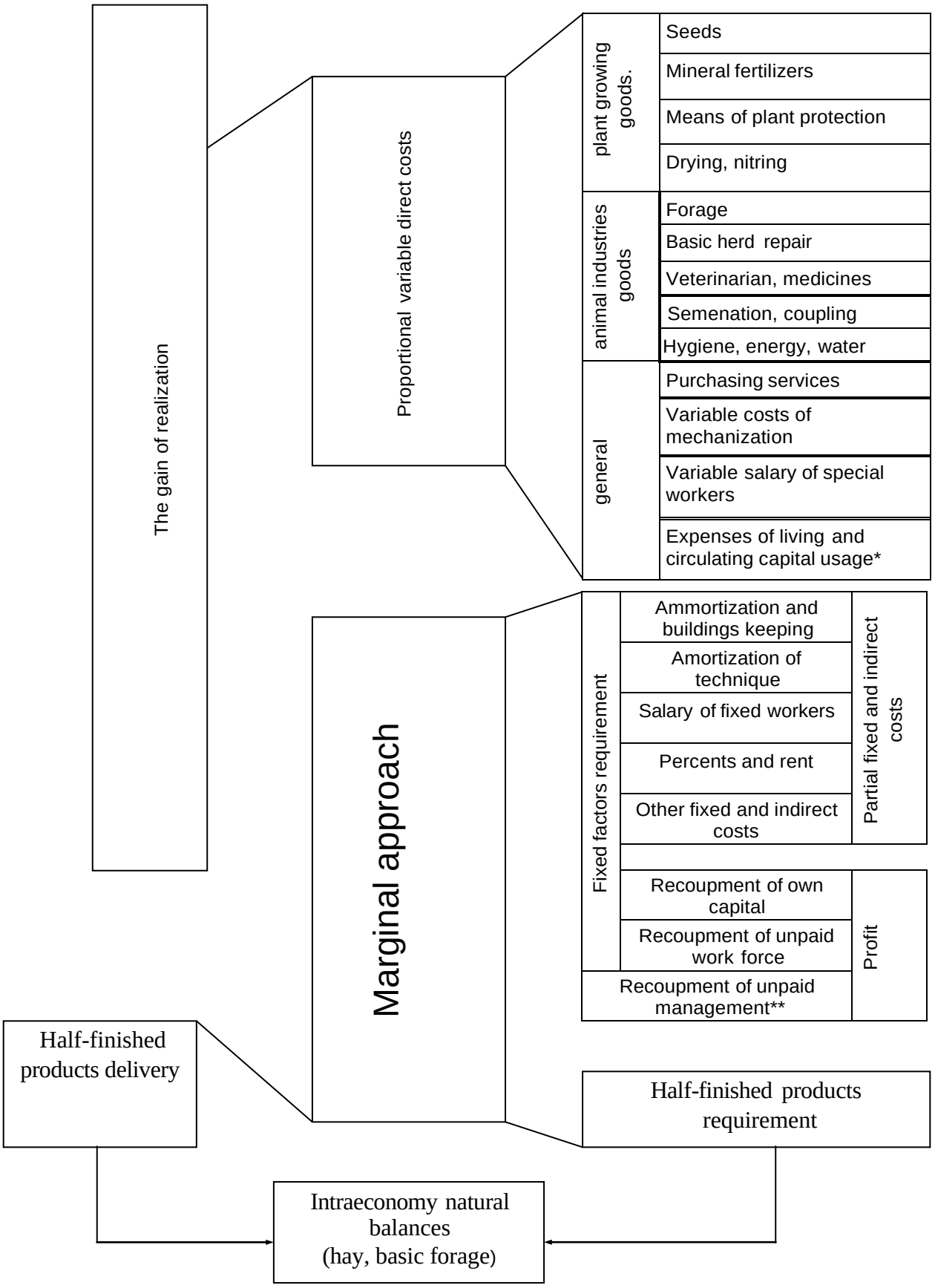
Practical method of marginal calculation. Practical method of marginal calculation is different from pointed before method in variable costs and half-finished products considering.

This method presupposes the consideration the costs which are variable as a rule.

There is no different caused by production level or planning period duration.

Fixed costs are not considered in this method of marginal calculation, they are substracted from marginal income late (see fig.4)

The advantages of this method are in that marginal income is actual for bigger level of production expansion and that additional costs (investments, rent and others) are considered in the planning at the household level and not attributed to certain products units on participial principle.



*)The rate of percent will be the part of profit, if the own capital is invested
**) Owner's profit

Fig.4. Terminological intercommunications in marginal calculation

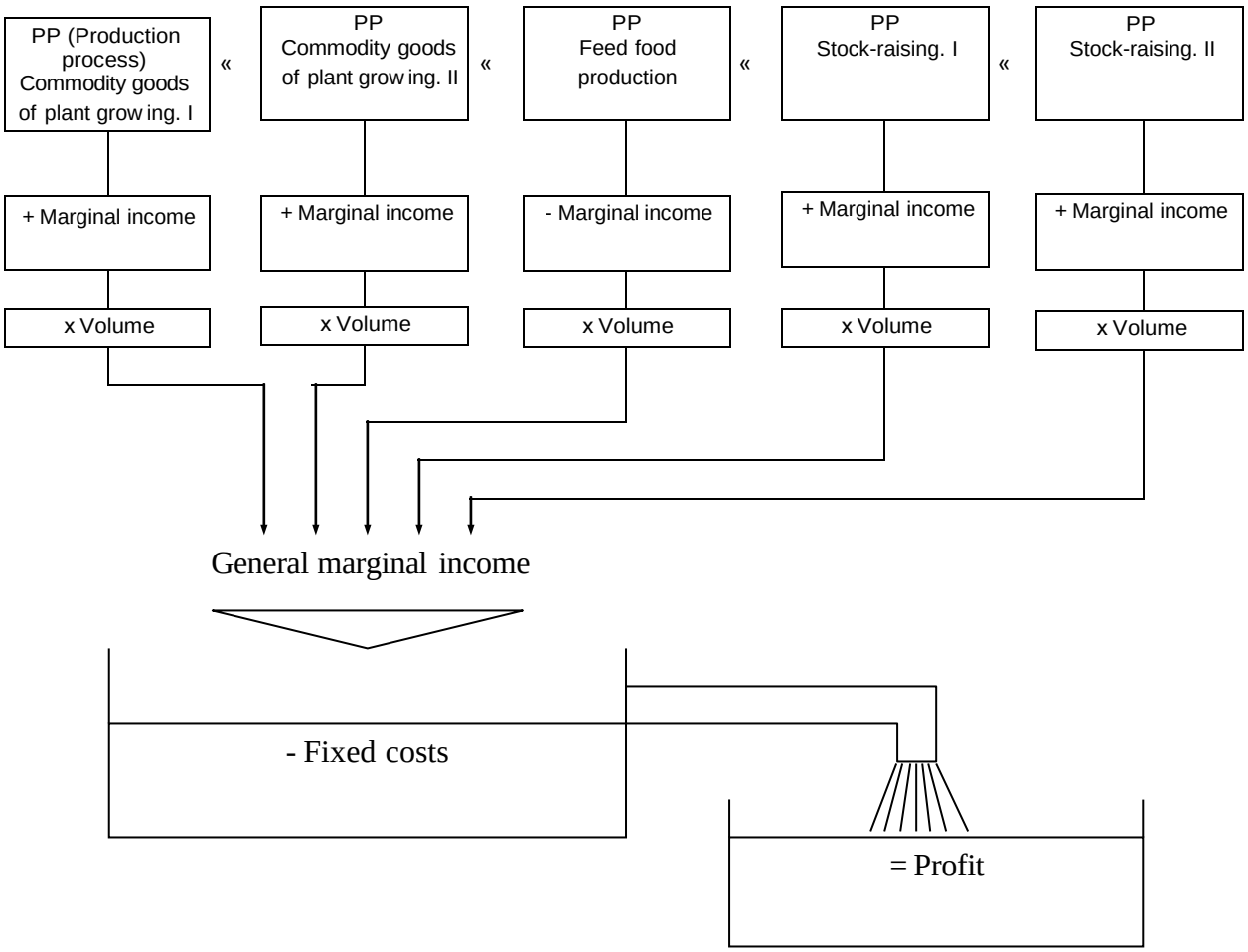


Fig.5. Terminological intercommunications in economy planning

The next difference is in that expenses of living and circulating capital usage are not considered as an item of costs. It is right also for salary of seasonal special work force often, because work force requirement and rate of percent can be calculated only at general household level, but not at the level of certain production process. Fixed production factors (invariable) are considered as natural requirement of factors.

The decision about the method of half-finished products estimation is made by each household independently. The estimation of half-finished products in natural sizes is the labour-intensive process. So for each case is preferably to estimate half-finished products in natural sizes and for another in monetary form.

For example: fertilizers (manure, liquid manure).

Fertilizers present themselves values made in animal husbandry processes. At the same time there are requirements of them in plant growing processes. These fertilizers may replace the mineral fertilizers and therefore they have the certain value of replacement. Estimation of replacement value bases on the quantity of nourishing

substances. So in practical calculations organic fertilizers (value of its replacement) are attributed to the gain of realization of stock-raising processes. The general requirement of nourishing substances in monetary expression is considered instead of mineral fertilizers in plant growing processes.

Advantages: there is no requirement to form the fertilizers balance. There is no need to distinct the organic and mineral fertilizers for estimation of nourishing substances plants requirement. The quantity of fertilizers output is calculated during the planning. Calculation of replacement value of organic fertilizers bases on optimal usage of nourishing substances as a rule.

It is not guaranteed in the household where stock-raising processes are higher development, so the replacement value will be calculated mistaken. If the quantity of cattle arises, the reduction of nourishing substances usage in organic fertilizers will be possible.

Example: Basic forage. Basic forages are required by ruminants and produced in feed food production processes. Its estimation is possible basing on relative purchasing prices as a rule. The estimation of replacement value is limited because its replacement is not possible always (different structure of forages).

In practice basic forages are produced for own requirements only. Even if purchasing and sae are possible, they will be at limited sizes only. If there is the need to decide how to fill in the general forage requirement cheaply, so the expenses of forage production will be the most important. So the estimation of purchasing value is unnecessary.

The forming of forage balances bases on nourishing substances maintenance. It means that balances formed on the base of energy, protein requirements estimation, but not such as silage, hay etc. Sometimes it is necessary to form the balance not only for year and also for each period of feeding. So it is possible to provide enough quantity of forage for winter.

In agriculture value changes proportionally production development. So there is no need to determine fixed and proportionally variable sizes (as, for example, variable costs).

In practical approach marginal income is calculated the next way:

	Gain of realization	**)Variable costs as a rule:*
+	*Value of each half-finished products*	*except for living and circulating capital usage expenses*
-	*proportionally variable costs*	*except for salary*
=	*Marginal income*	*inclusive estimated requirements of half-finished products*

So, marginal income shows how the general profit of household will change in condition of production expansion, if all proportional / fixed factors are available. This method of marginal estimation is more easily and exactly.

Gain of realization	+ Gain of realization	Gain of realization + approximate value of half-finished prod., if given	+ Gain of realization (Values are given)	+ Gain of realization for one class of households
Variable costs	– Variable costs incl. expenses of living and circulating capital usage and all expenses considered as variable, for example, expenses of buildings (if considered as variable)	– Proportional variable costs (expenses, which are variable as a rule) except for expenses of living and circulating assets usage	– Variable costs (expenses items, considered as variables are given)	– Data for one class of households
Marginal income	= Methodically actual marg. Income	= Marginal income by practical approach	= specific SMI of economy	= Standard marginal income (SMI)
Half-finished products	Requirements and purchase (for example, basic forage)	Requirements and purchase even if not considered in gain of realization or variable costs	Basic forage is not shown	
Requirement of fixed factors (factors are considered as fixed)	Areas Buildings Technique Work force	Areas Buildings Technique Work force	Not shown in general (fixed costs are calculated) = Standard fixed costs)	
Usage	<u>Optimization calculation</u> Determination of competitive scales Program planning II Linear programming	<u>Establish calculation</u> Reductive methods of planning ang profitability calculations, business plans for investors Advantage: a few of calculations Defect: requires the serious practical experience	Agrarian statistique Standard economy income estimation Profit of household estimation Comparison of households (comparison of processes and fixed costs) Determination of economy system Household production volume estimation (=Sizes of households depending on standard marginal income)	
Comparison between households	Not compared, because variable costs may include various items of expenses	Not compared, because variable costs may be divided variously and fixed factors also	Conditionally compared Own and another's mechanization determined for the class of households in average	

Fig. 6. Definitions of different marginal income

Standard marginal income. The estimation of standard marginal income allows comparing marginal incomes of various households at the general economy level. Its size depends on natural resources usage, market prices, economy development as a whole etc.

The standard marginal calculations allow to determination:

a) Economy system. It characterizes the economy structure and trends of its development, industries participation in general standard marginal income of economy.

b) Standard household income. It expresses the income and its origin for each household. It presents itself the difference between the general standard marginal income and standard fixed expenses of the household.

The estimation of standard marginal income allows determining the resources of income and its development:

- depending on the economy system and various production specializations;
- for various agrarian regions in accordance with their climatic features;
- for groups of households in accordance with their factors provisions and production volumes.

The results of estimation are used for work out and realization of the supporting measures for different regions and industries. The standard marginal income estimation size can be used at the various household for finding the problems.

4.4. Factors recoupment

The factors recoupment shows the recoupment of production factor by the certain production process realization. The calculating of recoupment bases on the calculation of full expenses (see the profitability threshold), but takes into account all values:

Value of production

– *General production costs *, except for analyzed factor's expenses*

= *Recoupment of all quantity of factor usage*

/ *Quantity of factor usage*

= *Recoupment of factor, per unit*

*) taking into account alternative costs

The factors recoupment is calculated for areas (UAH per 1 ha), labour (UAH per 1 human an hour), capital (UAH per 100 UAH invested capital in average). We can calculate the recoupment of other factors, for example: Recoupment:

- own capital / loan capital (percents of capital usage)
- own labour / another's labour (recoupment of labour) etc.

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THEME 2. ESTIMATION OF CIRCULATING CAPITAL REQUIREMENT

1. General information
2. Commodity goods production processes in plant growing.
3. The "Dairy cattle breeding" production process
4. “Pigs growing” production process
5. Production processes of “Big horned cattle (BHC) rearing” and “Bull’s fattening”
6. “Pig’s fattening” production process
7. Expenses of used living and circulating capital.

1. General information

In the process of agricultural production there are the next variable expenses arise up:

- Seed, fertilizers, means of plant protection;
- Concentrated forage, repair of population;
- Variable expenses of basic forage, salary, alternative expenses that, as a rule, arise up before than gain from realization considerably. For example seed for the production of winter wheat are bought in October, but the realization of products will take place only in September next year.

For realization of any production process there is the necessity of presence of capital for production assets purchasing. For these facilities a capital is needed short-term, in comparing to the fixed assets of production. ***As during one production process its cost returns to the businessman, as a rule, this capital is named circulating.***

Circulating means of the enterprise is a set of circulating capitals and circulating assets.

Circulating capitals represent a part of means of production which take part in one production cycle, thus transfer all cost on cost of finished goods and change the natural form. These are materials, designs, details.

Circulating assets is a part of circulating means in the form of commodity-material assets and a money resource of the enterprise which function in sphere of the reference, providing a continuity of production process.

As animals from the economic point of view execute, as a rule, similar with circulating production assets functions, these two types of property are united in a

group "**living and circulating capital**". The calculation of requirement of living and circulating facilities is necessary for:

- Determination of requirement of capital and financial means for a production process;
- Calculation of the expenses constrained with the capital usage.

A **requirement** in a living and circulating capital represents the average sum of the capital involved in the process of production. Expenses of the use of living and circulating capital in the process of calculation of actual sum of coverage at determination of comparative economic advantage of production processes are taken into account as variable.

At the level of separate enterprise a requirement of financial resources can be estimated by sum of requirements of the living and circulating capital for all production processes. At determination of liquidity of enterprise upon the certain date, this calculation will be not enough for lack of timely differentiation. A requirement of a circulating capital depends on:

- The volume of resources' expenses;
- Duration of capital's investment (date of return of the invested capital);
- Possibilities of the further usage of the again created capital.

A base for the calculation of duration of investment of capital is dates of payments, but not dates of purchase or sale.

The detailed calculation of requirement of living and circulating capital will have an especially large value for major agricultural concerns, because for purchasing of necessary production assets the considerable financial resources are needed. At the stowage of the real plan of financing the objective calculation of requirement of living and circulating capital is needed for every certain production process.

For stable agricultural domestic enterprises (farmers), this calculation, as a rule, has a second-rate value.

For example, the calculations of requirements of living and circulating capital for the most essential and widespread production processes are presented below.

2. Commodity goods production processes in plant growing.

The long duration of capital investment is the characteristic of the processes of commodity goods production in plant growing. Seed and other production assets for winter crops must be bought in autumn. But the capital will be released only after realization of grain few months ago.

For the approximate calculation of requirement of circulating capital it is necessary to know the exact dates of payments and receivables. It is important to take

into account that as point of estimation must be accepted date of payment for the production factors (seeds), but not the date of sowing, for example. At the calculation of duration of investment of capital it is important to know the date of payment for the realized harvest, but not the date of harvesting.

So the difference between these dates of payments is **duration of investment of capital** in days. The given below formula allows taking into account the different terms of investments of capital that are recounted into the ***annual*** requirement of circulating capital ***(ARLCC)***:

$$ARLCC = \frac{SP * DI}{365},$$

where SP – sum of payments; DI – investment duration, days.

Example: the seed were bought 10.10.2014 by 150 m.u. The date of payment from grain sale - 20.09.2015. Duration of investment of capital: from 10.10.2014 to 20.09.2015 = 345 days

annual requirement of circulating capital:

$$ARLCC = \frac{150 * 345}{365} = \mathbf{141.78\ m.u.}$$

The general average size of annual requirement of circulating capital bases on the sums of necessities of every type of expenses (seed, fertilizers, means of plant protection etc.).

The approximate calculations of requirement of circulating capital for production processes of winter and spring grain-crops growing are given in table 1.

In practice similar calculations are not conducted, as a rule.

Therefore at ***the calculation of requirement of circulating capital for the processes of production of commodity goods in plant growing there are used the next formulas of calculation***:

Table 1

FORMULA OF APPROXIMATE CALCULATION

Annual requirement of circulating capital	Commodity goods production processes of plant growing	
	Winter cultures	Spring cultures
	60%	40%
	Of all variable costs	Of all variable costs

3. The "Dairy cattle breeding" production process

Calculation of requirement of circulating capital for this production process is analogical to the calculation for the production processes of plant growing. But there are some features.

1) In the dairy cattle breeding the invested capital will return due to monthly receivables for the sold milk and calves during realization of production process. Distribution of receivables of the sold milk is watched on lactation curve of every cow. A difference between an average requirement of circulating capital and average sum of the returned circulating capital matches the annual requirement of circulating capital per 1 cow.

2) It is necessary to consider expenses of the production of basic forage more thoroughly. A requirement of circulating capital of the production of forage is reflected in the plans of household, as a rule. But in practice there is a problem, that duration of investment of capital in feed crop production (returns due to realization of milk) is more than 1 year. So ***it is accepted that a requirement of the capital, necessary for production of half of all basic forage in average, is distributed on all production period***.

The approximate calculation of requirement of living and circulating capital for a production process the "Dairy cattle breeding" is presented in a table 2.

Table 2

FORMULA OF APPROXIMATE CALCULATION

Annual requirement of living and circulating capital	Price of pedigree heifer purchase

4. “Pigs growing” production process

In the pigs growing production process a capital is releasing during its usage (like at the production process of milky cattle breeding). A gain of realization of pigs of first and second farrows covers production expenses. At the calculation of forage expenses, it is accepted that 1/4 of annual requirement of forage is present on an enterprise constantly.

The approximate calculation of requirement of living and circulating capital for a production process “Pigs growing” is presented in a table 3.

the approximate calculation of requirement is shown in a living and circulating capital for the productive process of "Growing of piglets".

Table 3

FORMULA OF APPROXIMATE CALCULATION

Annual requirement of living and circulating capital	Price of pedigree sow purchase +1/4 forage costs

5. Production processes of "Big horned cattle (BHC) rearing" and "Bulls fattening".

The durations of "Big horned cattle (BHC) rearing" and "Bulls fattening" production processes are more than 1 year. For unit of products it is taken one grown head of cattle per a year. Therefore payments that take place during more protracted period of time must be erected to annual.

It is accepted to consider that the half of annual requirement of basic forage is present at an enterprise constantly.

Table 4

FORMULA OF APPROXIMATE CALCULATION

Annual requirement of living and circulating capital	$\text{ARLCC} = \frac{PHP + VC}{2} + \frac{MD}{12}$ where PHP – price of heifer purchasing; VC – variable costs, all; MD – duration of cattle maintenance, months.

7. "Pigs fattening" production process.

This production period is less than 1 year. The inlaid capital releases and is again invested after every rotation of population.

Table 5

FORMULA OF APPROXIMATE CALCULATION

Annual requirement of living and circulating capital	$\text{ARLCC} = \frac{PHPig + 0.5FC + VC}{2} + \frac{FD}{365}$ where PHPig – price of pig purchasing; FC – forage costs per 1 pig ;VC – variable costs, all; FD – duration of fattening, days.

7. Expenses of used living and circulating capital.

Expenses on the invested living and circulating capital in accordance with classification of expenses belong to the proportionally-variable special expenses and that's why at the calculation of marginal income together with other proportional special expenses subtracted from a general gain of realization.

Expenses of used living and circulating capital present themselves the recoupment of certain part of production capital.

In practice it is accepted to examine expenses of used living and circulating capital as they are to compare the economic efficiency of different enterprises or production processes.

At intrahousehold planning these expenses are examine only at the level of household (calculation of general household indices of efficiency).

There are no **depreciation decrees**, taken into account in calculation of expenses of used living and circulating capital. This group of capital transfers its value into end products completely during 1 production period

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THEME 3. GENERAL ECONOMIC ASPECTS OF PLANT GROWING

1. Structure and trends of plant growing development
2. Biological and economic bases
3. Questions of efficiency of some spheres

1. Structure and trends of plant growing development

Plant growing is the basic stage of agricultural production. The used cultures express biological variety and there are significant differences of needed production factors and productivity of plant growing processes.

1.1. Systematization of cultures

Economic systematization of cultures may be done by different criteria. There will be one or another principle of classification more correct depending on the aim of groupment. There is possibility to systematize the cultures by character of areas usage in production process. So cultures are divided into the grown: the meadows, arable lands, pastures and areas under perennial plants.

Table 6. Systematization of agricultural effective areas

Type of culture	Basic groups	Types of fruits / Types of usage
Arable land	grain-growing	wheat, barley, rye, oat, corn on grain
	leguminous	faricot, pea, lupin
	arabled	potato, sugar beet, mangle beet, feed
		carrot, feed cabbage
	oil-bearing	rape
	cultivated forage	corn on a silo, clover, lucerne etc.
	field vegetables	vegetables, seedling, seed
	seedling for sale	tobacco, herbs, spicy plants, flax, hemp
Meadows and	meadows	mowing (green feed, hay)
pastures	pastures	use under a pasture
	mowed	combined mowing and use as pastures
	pastures	pasture
	haymakings	haying usage
Perennial	gardens and berry patches	pip, drupaceous, nuts, berry patches and bushes
cultures	vineyards	vine
	hop-gardens	hop

Arable land is characterized by regular treatments. The cultures of this kind must be cultivated and harvested in certain terms. It supposes cultivation by modern machines and devices. In opposition to it meadows and pastures are used as such unlimited time. The requirements to the location are less than for cultures on arable lands. Perennial cultures are designated also as the special cultures due to their special economic features. The cultivation of them requires the presence of special constructions such as cultures themselves and additional constructions (fence, for example).

A production presupposes making of building and their current service. A harvest consists of parts of plants (fruits, inflorescences) which are harvested after first productivity or unproductivity years annually during more than 20 to 40 years.

1.2. Cultures, cultivated on arable lands

Cultivation of cultures at arable lands in central European conditions presupposes annual changing of plants of different kinds, as a rule. Today there is the need to systematize cultures by arable, economic-technical signs, and also by evaluation of finish goods (Table 7).

Table 7. Systematization of the cultures on kinds by different criteria

<table>
<tr><th>Agrarian-statistical account</th><th>Arable and botanical distribution</th><th>Economic intensity</th></tr>
<tr><td>grain-growing</td><td>cereals</td><td rowspan="5">extensive cultures</td></tr>
<tr><td>corn on grain</td><td rowspan="9">leaf (ungrain-growing)</td></tr>
<tr><td>leguminous</td></tr>
<tr><td>oil-bearing</td></tr>
<tr><td>forage</td></tr>
<tr><td>cultivated</td><td rowspan="2">intensive cultures</td></tr>
<tr><td>vegetables</td></tr>
<tr><td>intermediate cultures</td><td rowspan="2">extensive cultures</td></tr>
<tr><td>fallow</td></tr>
</table>

Cereals and leaf cultures; extensive and intensive cultures. Cereals occupy greater part of arable area. They are identical to the types of grain-growing. Sheet cultures embrace different groups of plants. They are spring or perennial (clover, lucerne), except for oil-bearing. The cultivated cultures are characterized by high production costs and high volume of production factors usage. Therefore they are

named intensive cultures. All other sheet cultures are named extensive (corn on a grain and silo also).

Basic, repeated and intermediate cultures. In the Centrally-European conditions the only one culture can be cultivated at one vegetation period in general. Two kinds of plants may be cultivated per year only in climatic favorable conditions.

There are distinguished such types of cultures as basic, intermediate and repeated, depending on the size of the productivity. For example, the carrot with vegetation period 80-90 days can be cultivated after early potato.

Cultures that are grown in an interval between the periods of cultivation of two basic cultures, are named intermediate cultures; they can be both as spring so winter.

The cultures harvested by a combine, dug up, mowed and collected. Depending on the way of harvesting the cultures are divided into types, presented at the table 8.

Table 8. Classification of basic cultures by technical requirements, conditioned by harvesting

Products	Grains and seed	Green mass	Fruits, flowers, leaves	Roots, tubers
	grain-growing	meadows and pastures arable forage	fruits pea \ apricot	beet, potato
	corn on grain		hop	
	rape		vineyards	
	hayseeds		tobacco	
Harvesting	combining	mowing		excavation
	special cases:		collecting	
	separation of ears with		shaking off	
	simultaneous threshing		cutting away	
	threshing from rollers		breaking etc.	
Group of plants	**cultures, harvested by combine**	**mowed cultures**	**collected cultures**	**dug up cultures**

1.3. Structure and changes of areas usage.

The parts of separate types of cultures in the agricultural used area are expressed in correlation of the used area, arable land. They are continuously changed in accordance with technical and economic correlations.

Long-term tendency of agricultural area reducing on the average on 60000 ha per a year follows from an increasing requirement in areas for building, industry and public building (e.g. roads). Basic signs of the use of arable land in the examined period are following:

- Volume of cultivation of grain-growing remained permanent, although the fallow parts increase.
- Part of forage goes down constantly, foremost for clover and lucerne.
- Cultivation of leguminous and oily has increased.
- Immobilization of areas has increased, in accordance with agrarian-political decisions.
- Part of arable hasn't changed almost.

1.4. Changes in correlations of incomes and expenses

The changes of structure of cultivation are explained by next factors:

- technical progress
- changing correlation of price and expenses
- political events (bonuses within the framework of EU)

Development of the productivity of the basic field cultures is shown on a next scheme.

In regard to development of the productivity it is necessary to mark next tendencies:

- The productivity of all types of cultures rose notedly.
- A most increase is attained at cultivation of grain-growing.
- The least increases of the productivity are attained in feed crop production and cultivation of leguminous. Increase of the productivity of grain crops is explained by application of facilities of shortening of stem in combination enhanceable bringing of nitric fertilizers and by the directed use of pesticides.

Introduction of hybrid sorts of rye led to the hyperproportional increase of the productivity. It is also necessary to point, that along with quantitative signs the productive qualities became better notedly:

- more early maturity, taste qualities, maintenance of starch, stability to to the diseases at a potato;

- stability to to the diseases at a sugar beet;
- high concentration of dry substance and energy in a corn on a silo.

It is necessary to mark that technology of cultivation considerably changed for the last 3 decades by:

- increasing usage of production assets, rising the productivity,
- by application of saving work time processes,
- by plant-breeding-technical progress (hybrid sorts etc.).

It is possible to distinguish three influences of changing technical and economic requirements to all types of cultures:

- increase of production,
- reducing the expenses
- expansion of capacity.

2 .Biological and economic bases

Types of cultures considerably differentiate by biological and economic signs. So there are substantial distinctions between one-year and perennial cultures, and also between cultures on arable lands, meadows and pastures. There are different requirements to the crop rotations of cultures at arable lands.

2.1. Forms of arable land organization

Bases and reasons of crop rotation choice. There are important such statements:

- specific features of location,
- relations a previous culture – subsequent culture
- influences of cultures in general organization of economy
- goal of economy.

Crop rotation and monoculture. One-sided cultivation of one culture at the same area conduces to impoverishment certain layers of soil, worsening of the state of soil and accumulation of harmful fungi, weeds and animals. Technological events such as plants protection, bringing of fertilizers and intensive processing of soil can compensate these negative influences to a certain degree, but not to remove fully. Cultivation of monocultures, e.g. wheat is successfully practiced during many years but at certain conditions. There is the necessity to take into account biological intercommunications to increase the productivity.

Compatibility of plants at cultivating by the second culture, after other culture. The temporal sequence of many cultures is limited by specific illnesses, wreckers or weeds. Foremost the some leguminous have subzero compatibility. The

corn and rye are an exact opposite. Rape, sugar beet, pea, clover have very small compatibility with other plants. Wheat and barley in crop rotations with the large stake of grain-growing have the same compatibility. There is the most important for these groups of plants to take into account the danger of appearance of illnesses of crop rotation. It will require the large bringing of assets to fight them.

Creation of humus and culture, reducing maintenance of humus in soil. Balance of humus affects to the fertility of soil. It presents correlation between consumption and bringing of humus. Arable crops, as a corn on a silo, sugar beet, with the removal of leaves reduce the content of humus in soil strongly. It leads to taken into account reverse bringing of organic substance in manure form (liquid and hard). The grain-growing are considered as plants assisting the increase of humus in soil. The humus is increased due to vegetable bits and pieces of cultures serve (straw, sideration of cultivated intermediate cultures).

Shares of grain and sheet crops. Numerous experiments in crop rotations showed close intercommunication between shares of leaf cultures in arable land and average productivity of grain crops. There are the next connections: With the going down share of leaf (increasing share of grain crops) at arable lands:

- the average productivity of grain crops goes down,
- average marginal income goes down relatively stronger, than average income, because
- variable expenses per ha of grain crops remain permanent almost.
- the marginal income of additional areas under grain crops reduces stronger in all.

Influence of previous cultures is explained as follows: at abandonment from expansion of share of grain crops the average marginal income does not reduce.

Forage providing. Today cattle and bird breeding does not depend on sizes of areas.

Development of products prices and factors of production. Development of products prices, factors of production and areas rent influence on crop rotations the most.

Systematization of crop rotations

The systems of cultivating used in different regions, may be divided into three basic forms:

Removable system of agriculture. At this system the perennial culture or arable land under one-year culture are replaced by ancient vegetation (bushes, steppe and forest). It leads to restore the soil fertility by natural way in long-term period.

Multifield-grass system of agriculture. Fertility of soil is used during limit number of years by one-year culture and then the period of growing fodder crops follows ("rest of area" period).

Crop rotations with the one-year field cultures. All area of arable is taken under rotary system of cultivation with one-year cultures separately from an area under perennial cultures. Such crop rotations have the most requirements to soil and climate, and to production assets usage also.

Sheet culture with the following cereals form the link of crop rotation. There are distinquished di-, three- and multifield links. Their combination gives as a result in practice the crop rotation.

2.2. Treatment of meadows and pastures

If the meadows area can be used as arable land, so there will be the necessity to take into account alternative expenses in calculation of forage usage expenses.

The forms of the meadows and pastures usage are characterized by the process of forage receiving: an old form is a pasture. If there is the only haying usage, there will be named meadow. At the haying-pascual meadow usage the both forms change from year to year or during a vegetation period.

Table 9. Forms of the usage and stages of intensity of meadows and pastures

Forms of the usage and stages of intensity			
pasture	hay-crop pasture		meadow
permanent pasture			hay
- extensive			
- intensive			
pound pasture	periodic changing	seasonal changing	silo
a la carte-pound pasture			green feed

Permanent pasture. Animals get pascual areas without further subdivision. It conducts frequently to very uneven formation of harvest and complicates influence on herbage. There is the low level of fertilizers bringing and plants protection measurements, as a rule. It leads to low areas productivity. The concentrating of forage doesn't take place, as a rule. The special form is an intensive permanent

pasture where the closeness of pasture and intensity of fertilizers bringing correspond to intensive pound pasture. The closeness of pasture at the use of pastures must constantly to correspond to the increase of production. It goes down during a vegetation period from 5-6 cows/of ha in May-August to 3-4 cows/of ha in October. There are such preliminary conditions for this system: wide consolidation of areas and sufficient for pasture herbage. An aim of this system is an economy of investments (drinking bowls, fences) and work.

Pound pasture. All area of pasture is divided into pound and population (closeness of pasture) so, that eating up of plants takes place in 2-4 days. After that an area of pasture "has" a rest for 2-4 weeks that can be used for fertilizers bringing and realization of plants protection measures. Thus the use of pasture becomes possible for 4-5 times per a year that conducts to higher productivity and the best quality of forage.

***A la carte-pound pasture*.** Areas are divided for pastured animals into daily or half-daily portions. It allows to provide the eating up of forage with the least losses. Eating up of forage is arrived at it with the least losses. So at favorable terms there is possible to achieve 5-7 uses with high productivity. Certainly, this form of the use has most production requirements (dividing into pound, setting of drinking bowls, turns). The requirement of capital increases also.

***Meadows*.** The most productivity with the least losses of harvest (5-10%) are achieved at the use as a green feed. The losses of harvest at preparation of haylage are counted at the level of 15-20% and at the purveyance of hay - 20-30%. This form of areas usage is characterized by lower expenses of fertilizers bringing, maintenance in comparison with pastures. But it is necessary to take into account such expenses as mowing and transportation forage to animals. A decision about usage the area as meadows or pastures, depends on next factors also:

- natural geographical terms
- distance between stock-raising buildings and meadows and pastures
- technical difficulties (e.g. road-crossing with intensive motion)
- infection vermin
- too strong loculatedness of meadows and pastures

Production and technical intercommunications

While harvesting of cultures at arable land is conducted only one time per period of vegetation in the certain term of biological maturity, terms and frequency of harvesting of meadows and pastures depend on the decision of farmer. He must choose events and terms for getting the optimal productivity of high-quality feed. It is

thus necessary to take into account next points: At three mowing in a year a harvest is distributed approximately as follows: 1.Mowing - 50%, 2.Mowing - 30%, 3.Mowing - 20%. At the belated use content of energy and protein goes down per the kg of dry mass and content of raw cellulose increases in forage. The frequent usage optional conducts to high productivity, instead a feed can have a high value in regard to content of protein and energy The optimal terms of the use must be determined taking into account the types of animals, because the requirements of animal to quality of forage are different. Requirements of separate types of animals go down in the presented sequence: cows, animals on fattening, heifers, cows with calves, horse, sheep.

Table 10. Influence of different degrees of intensity of treatment of meadows and pastures

Terms of mowing		**09.05.**		**15.05.**		**22.05.**	
Level of N (nitrogen)		40	80	40	80	40	80
Content of protein	% / kg of RM	16,7	20,8	15,5	18,1	14,8	16,2
Content of energy	% / kg of RM	6,08	6,36	5,99	5,55	5,45	5,14
Dry mass(CM)	c / ha	45	54	53	65	68	72
Exit of nutritive	mJ / ha	27488	34048	31825	35972	37049	36772

2.3. Relations of replacement between the types of cultures

It is necessary to pay attention to next aspects:

- All types of cultures compete for limit disposable production factors, thus natural production terms cause the first rough limitation of separate cultures with an advantageous location.
- What any more intensive cultures (e.g. hop, tobacco) use production resources and then higher their contribution to the profit, the more danger, that arable-land will be neglected.
- It leads to the one-sided preference of grain-growing, requiring small expenses of labour.
- An alike effect takes place in economies with plenty of animals and in side enterprises.

3. Questions of efficiency of some spheres

Production processes of plant growing require economic reasonable decisions relatively:

- Implementation of works and machines presence;
- Bringing of organic and mineral fertilizers;
- Geographical hygiene and plants protection.

3.1. Implementation of works and machines presence

For well-organized, timely and quality implementation of works in a plant growing there is the necessity to take into account next principles:

- Separate productive processes have various requirements of work time during a vegetation period.
- Works are mainly related to the certain terms of implementation and admit an only limit temporal displacement.
- In the certain intervals of time in order to different soil and weather conditions there is an only limit number of days of the field works, that depends on corresponding climatic terms.
- There are technical aggregates with the different productivity and corresponding expenses for implementation of most works today.

3.2. Bringing of organic and mineral fertilizers

In historical development the bringing of organic fertilizers in manure form that served at the same time to the reception of humus and nutritive played a large role, and general organization of economy was directed to the requirement of arable land necessary in manure satisfaction. In spite of the fact that today providing of nutritive is conducted by mineral fertilizers mainly, providing of soil by organic substances has saved its own meaning, because these substances influence on activation of soil life, improvement of soil structure and accumulation of nutritives.

Bringing of organic fertilizers. Long-term fertility of soil will go down, if the consumption of humus is more than him receipt, as a rule. Therefore from the economic point of view it is important to provide the needed content of humus in soil with the least costs. A general requirement in organic material depends on a location and treatments of soils. A requirement in the humus of easy or sandy soils is higher, than at heavy soils. Intensity of treatment of soil influences both on a requirement of a humus and at choice of cultures. The net-balance-process of units of spudding of soil and receipt of humus is used for evaluation of dissolving of humus. The one unit

of spudding of soil attributes to average dissolving of humus – 35 c RM/ ha per year. Depending on this, the cultures are divided into:

- potato, beet, corn - 2
- grain-growing, rape - 1
- stubble intermediate cultures - 0,5
- sowing of subintegumentary cultures, perennial feed crops - 0

It is possible to calculate the net-balance of humus as shown in the table 11.

Table 11. Influence of different production processes into balance of humus

Production process	Units of spudding of soil	Calculation dissolving of humus c of organic dry mass	Crop, after harvesting remains	Net- balance
Potato	2	70	8	-62
Sugar beet with harvesting of tops	2	70	8	- 62
Sugar beet with abandonment of tops in the field	2	70	68	-2
Grain crops with harvestiong of straw	1	35	14	-21
Grain crops with abandonment of straw	1	35	54	19
3-years lucerne	0	0	67	67
2-years lucerne	0	0	56	56
Corn on a silo	2	70	10	-60
Sideration by under sowing cultures	0	0	47	47
Stubble sowing of sidereal cultures	0,5	17,5	40	22,5

In the scarce production processes there is the necessity to estimate the net-balance-processes with the expenses of soil humus renewal and consider them as additional expenses. The surpluses of humus balance present themselves the

additional value. The coverage of deficit of organic fertilizers may be done by the next ways:

- by the manure bringing, got in industry of stock-raising;
- by means of abandonment of straw and other products of harvesting (e.g. tops of beet) at arable land;
- the wrapping of straw with a sideration and corresponding smoothing of balance of nitrogen can completely replace the manure in households without animals maintenance;
- by composting (gardening economies)

***Bringing of mineral fertilizers*.** The economic aspects of this process include the decisions about: How does it possible to provide the optimal content of nutritives, taking into account the quantity, distribution and intensity of fertilizers.

The choice of the most advantageously system of fertilizers bringing.

There is the necessity to choose the process with minimal costs, taking into account expenses of purchasing, storage and bringing.

The fertilizers bringing submit to the law of going down increase of income. The optimal level of fertilizers bringing has achieved as the price of fertilize unit is less than the marginal income of its usage. For explanation we will give an example of bringing of nitric fertilizers:

Table 12

Bringing of nitric fertilizers, kg/of ha	Productivity, c/ha	Gain of realization, DM/of ha	Expenses of bringing of N, DM/of ha	Gain of realization - expenses of bringing of N	Marginal profit (DM/of kg of N)
50	60,75	1640	65,0	1575	
75	65,81	1777	97,5	1679	4,17
100	70,10	1893	130,0	1763	3,33
125	73,61	1988	162,5	1825	2,49
150	76,35	2061	195,0	1866	1,66
175	78,31	2114	227,5	1887	0,82
200	79,50	2147	260,0	1887	-0,02
225	79,91	2158	292,5	1865	-0,85
250	79,55	2148	325,0	1823	-1,69
275	78,41	2117	357,5	1760	-2,53
300	76,50	2066	390,0	1676	-3,37

There is the next function of the productivity of winter wheat depending on bringing of nitric fertilizers:

Productivity (y) = 48,3 + 0.28 * kg of N/ha - 0.00063 * kg of N/ha^2

The price of nitric fertilizers, including the expenses of bringing is 1,30 DM/of kg. The price of product is 27 DM/c. The next results are got, taking into account the changeable level of nitrogen (table 12).

So, the economic optimum is achieved approximately at 175 kg of N/of ha.

In practice the determination of optimum is more difficult because:

- There is a vagueness about a weather, natural mineralization of soil etc. to the term of application of separate doses of nitrogen.
- The correct choice of terms of bringing of fertilizers is very important. So about 50% nitrogen is mastered by grain-growing in earing phase.
- There is the necessity to take into account quality differences of certain products. They affect into price of products.
- Influence of phytosanitary measures must be taken into account also. It is necessary to consider that at the increasing level of nitrogen, the usage of fungicides, insecticides must be increased too. So the expenses will increase too (due to “accompanying factors” complex change).

The system of fertilizers bringing is the general complex of technical and organizational providing of fertilizers bringing. Systems of fertilizers bringing with minimum expenses and economically optimal providing of nutritives also differ by a choice, purchasing and type of bringing of fertilizers. There are the important statements:

- Expenses of kg of operating substance.
- Concentration of operating substances and their combination (fertilize with one or few operating substances).
- Solubility and availability to the plants in soil (e.g. ammoniacal and nitrate forms).
- Positive and/or negative by-effects; this aspect is taken into account at comparison of expenses
- Physiological influences of fertilizers; this aspect needs to be also taken into account at comparison of expenses.

The suppliers of fertilizers offer prices on the operating substances differentiated by the seasons, discounts at an early purchase, volume discounts etc. Therefore at comparison of expenses it is necessary to take into account the appearing

expenses of the use of loan capital, involved on different periods. Different expenses of transportation, loading and unloading also must be taken into account.

The optimal system of fertilizers bringing can be determined basing on the model of synchronic planning (Linear programming) as a model of expenses minimization for given and changeable price and economy conditions.

3.3. Prophylactic and active plants protection

The plants protection covers all measures, directed into receiving the healthy vegetation, free of negative influence on the productivity and quality of cultures by the fight against weeds, wreckers and illnesses. It is subdivided into 2 basic directions, depending on aims of plant protection:

- Events aimed at the improvement of plants and their microenvironment. They are designated as prophylactic plants protection.
- Events aimed at the the direct fight against reasons and danger of plants damage are designated as active plants protection.

Prophylactic plants protection. The prophylactic plants protection covers the measures that lead to optimal vegetation providing in the set geographical conditions. There are the next important factors:

- Technique of treatment in accordance with plants
- Necessary events are conducted in time. For example, preseed treatment of soil, closeness and terms of sowing, determine initial phases of plants development significantly.
- Choice of plants and sorts, justified by a location (districted sorts). For example, at the use of steady sorts the sowing expenses increase and productivity may to reduce, but the expenses of plants protection assets usage reduce too.
- “Healthy" crop rotations. At short-term consideration "unhealthy" crop rotations fully can be compensated by enhanceable protection of plants. In long-term period the ignoring of prophylactic aspects can result in illnesses of the plants caused their wrong placing in a crop rotation.

Active plants protection. There are important decisions from the economic point of view:

- Optimal amount of the assets usage
- Optimal choice of means and processes
- Choice of optimal terms of measures realization

Thresholds of harmfulness and fight. Determination of degree of defeat and effectiveness has been made to the moment of harvesting. There are some indices of estimation of degree of defeat.

The first important factor is threshold of harmfulness.

Threshold of harmfulness = Degree of defeat at that the first harmful influences appear.

If the degree of defeat lies higher than threshold of harmfulness, so there will appear a question about a threshold of economic application of fight measures

Threshold of fight = Degree of defeat, that justifies an economic fight

Threshold of fight will be over if the expected losses of income without protection measures are more than expenses of plant protection measures.

The expected marginal income >= Marginal expenses

Expenses of realization plants protection measures. They are the expenses of assets and bringing generally.

1. Expenses of assets = Amount of bringing * Price of factor;
2. Expenses of bringing = Expenses of machines usage (variable expenses, generally), auxiliary materials (water) and Requirement of work time (Salary or alternative expenses of family members work) * Price of factor;

Results of plants protection:

They can be divided into main and side results:

1. Main: Reducing of damage to the harvest (A harvest * Price of products), Reducing of damage to the quality
2. Side: Side effect increasing the productivity (e.g. at the use of shortening of stem assets)

- Effect of facilitation of works (e.g. harvesting at a subzero impurit; Estimation: Economy of works * Price of factor
- Effects of economy of expenses (reduced expenses of drying, lowered application of herbicides in subsequent years)
- Reduction of risk (e.g. application of fungicides with a wide action)

For an economic analysis it is necessary to estimate basic sizes with sufficient exactness and to overcome their influences a corresponding model.

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THEME 4. PRODUCTION OF COMMODITY GOODS OF PLANT GROWING

1. General remarks
2. The gain of realization
3. Variable expenses
4. A requirement of production factors
5. Aspects of marginal calculation
6. Thresholds of production and profitability
7. Recoupment of factors and their productivity

1. General remarks

A certain production process is designated through:

Value: kind and amount of got basic and side products estimated in natural or monetary sizes; commodity or uncommodity;

Variable special costs: kind and amount of production assets required to produce the unit of products;

Requirement of factors: volume and structure of requirements of limited production capacities for each unit of products.

For estimation of certain process of plant growing there are needed the next data, first of all:

- Type of plant, its sort
- System of cultivation (size of the fields, amount of harvests in a year, irrigated etc.)
- Production indices (e.g. productivity, quality, content of nutritives)
- Use of products (e.g. realization, feeding, green fertilizer)
- Input (e.g. fertilizer, means of plants protection, insurance, work)
- Prices on commodity products and production facilities
- Mechanization (kind and expenses of own and another's mechanization)

For the calculation of marginal income, it is necessary, that all costs, expenses and requirements in factors were submitted for certain period and area. Marginal income is estimated per 1 ha in a year, as a rule. The straw is considered as a side product. There are used the different methods of straw account in calculations, depending on its usage: straw as commodity side product or straw as uncommodity side product (half-finished product).

Fertilizers are brought basing on the economic-actual requirement of fertilizers.

The expenses of bringing of means of plants protection are taken into account at the calculation of variable costs of mechanization (or at determination of costs of another's mechanization services).

2. The gain of realization

The harvest of uncommodity products is expressed, as a rule, in natural units and not estimated. For example, if this harvest serves as production forage, then the productivity will be expressed in nutritives (see feed crop production process).

At planning there is taken the real long-term productivity mainly. This productivity bases on the average productivity of the last years.

The harvest of wheat depending on quality is divided into a flour-miller and feed-stuff wheat. The different market prices are formed depending on quality. The straw is considered as a side product. There are used the different methods for the account of straw in calculations, depending on its usage. In a model calculation there are come from that a straw is wrapped by tighter.

Straw as commodity side products. Estimation: the Realization price(franco-court-price)

Straw as uncommodity side products (half-finished product)

Straw as underlay in a stock-raising:

Step 1: Expression in natural sizes (quantity) for a calculation in balance of straw at the level of household, thus deficits (calculated) are purchased, and surpluses (calculated) are sold, arable or fed.

Step 2: Estimation on intrahousehold calculation prices

Straw as basic pet forage

Step 1: Expression in natural sizes (amount of nutritives) for calculation in balance of forage at the level of household, thus deficits (calculated) are purchased, and surpluses (calculated) are sold, arable or used as underlay.

Step 2: Estimation on intrahousehold calculation prices

Straw as a fertilizer

Step 1: Expression in natural sizes (amount of nutritives) for calculation of requirement of nutritives with an account of their bearing-out.

Step 2: Estimation on intrahousehold calculation prices

3. Variable expenses

The market price is used at application of the purchased seed. At own seed application there is used the market price of grain with 20% addition to compensate

the expenses of storage, natural decrease, expenses of preparation etc. Thus are used the average values

Fertilizers

There are distinguished the plant growing and economic-actual requirements of fertilizers.

Plant growing requirement of fertilizers (recommendations on bringing). Aim is to determine the necessary amount of fertilizers. Calculation is made basing on a bearing-out and necessity of plants in nutritives with taking into account their supply in soil (for example remaining action from bringing fertilizers under the culture-predecessor), the assimilating level etc.

Economic-actual requirement of fertilizers. Aim is to determine the amount of nutritives, necessary for indemnifications of damage inflicted to balance of nutritives in soil by the certain culture cultivation.

Calculation is made by approximate formula:

$$LN * RF = RN - RNfS = RFnet,$$

where

LN- losses of nutritives;

RF - factor of requirement;

RN – requirement of nutritives;

RNfS - return of nutritives from remaining on the field overhead parts of plants;

RFnet – requirement of fertilizers net on.

Loss of nutritives presents the quantity of kilograms of operating substance contented in the harvested crop, calculated on the determined amount of products, for example per a 1 ton of grain.

Factor of requirement is the factor used to determine the requirement of nutritives taking into account the existent soil and climatic conditions.

A requirement of nutritives is the necessary amount of nutritives (organic or mineral) in kilograms, which provides the production of certain quantity of grain (for example) at existent soil and climatic conditions.

Return of nutritives from remaining on the field overhead parts of plants is the suitable to the use (equivalent to the mineral fertilizers) return of nutritives from untidy parts of plants, taken into account at determination of loss of nutritives and requirement of them. There is the remaining action of nitrogen after a predecessor from family of leguminous also.

The remaining action of nitrogen from a predecessor is used by a subsequent culture. It presents itself the cost of production process, that at the described method is taken into account through the decline of requirement of nutritives.

At the expenses estimation there are used the prices of 1 kg of net nutritive (because a net on requirement of nutritives is expressed in kg of net nutritives).

There is the necessity to consider the bringing of fertilizers making better quality of soil (the land reclamation bringing of fertilizers) as fixed costs, because these expenses are caused by not only certain culture.

Plants protection

Expenses of plants protection means usage

The expenses of plants protection (per 1 ha) are estimated by the multiplication the amount of used means (per 1 ha) with the expenses per unit (l, kg).

The expenses of bringing of means of plants protection are taken into account at the calculation of variable expenses of mechanization (or at determination of expenses of another's mechanization services).

The expenses of treatment of seed (stainsing) are taken into account only in that case degree in which they are not taken into account at determination of expenses of seed.

There are needed the higher expenses of plants protection in the example of calculation for the process II by the reason of the higher productivity. This calculation is presented separately.

Mechanization

The mechanization is divided into own and another's for the purpose of expenses estimation. The expenses of another's mechanization are formed by the expenses of another's machines usage and the expenses of service workers (if they are given).

The determination of expenses of own mechanization is based on the variable costs of own technique usage. A requirement of work time (own work force) for maintenance of own technique is expressed in natural sizes (man.-hour.).

This method was applied in the example of calculation. In order to avoid the double calculation, every technological operation is considered separately. The higher level of mechanization at the process II, also considered separately. The next way of determination of own mechanization expenses is to use the data about mechanization expenses of different technological operations from special literature, taking into account a necessity of propelling force and sizes of the fields.

Other

At the calculation there are considered the next expenses:

Insurance from a hail. Payment depends on the size of gain of realization, as a rule. That's why at calculation the payment is 1,5% from a gain of realization (without bonuses).

Drying. Expenses of drying are 2,60 DM per 1 c. It is assumed that on the average the 25% of harvest require drying.

Storage, canning, preparation. Expenses of storage, canning and preparation of harvest needs to be attribute to chosen unit (e.g. ha in a year).

Expenses of realization. The expenses of realization must be taken into account. The easily way to do it is to subtract them from market price and so to estimate the gain of realization using the franco-court of price.

4. Marginal income.

The marginal income is the difference between the gain from realization (with direct transfers such as bonuses for area) and proportionally-variable special expenses.

This sum is needed for coverage fixed and indirect costs, and for formation of profit also. Thus, the size of marginal income shows as far as to rise general profit at expansion of production process on a 1 unit, in conditions that all necessary fixed factors of production are present in an order

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5. A requirement of production factors

A requirement of the landed resources. The requirement of areas at plant growing production processes depends on the vegetation period of certain culture. If an area is used only one time in a year, then a requirement of area of the conducted

process is 1 ha. At reusing of one area this size is reducing accordingly. Intermediate cultures do not have a requirement of area, as a rule.

A requirement of work resources. The determination of requirement of work time in the example of calculation is divided into work operations and tense periods of work.

A requirement of circulating assets. In the example of calculation requirement of circulating assets (average involved circulating capital) is taken simplified as 60 % of proportional variable expenses.

6. Aspects of marginal calculation

The proportional variable costs includes also the next:

- Percent of living and circulating capital
- Work expenses
- Alternative costs (for areas, buildings etc.)

In exact calculation these expenses with other proportional variable direct costs are subtracted from income. There is no need to do so in practical approximate calculation.

Expenses of the living and circulating capital usage. Percents to circulating (and living) assets presents themselves the expenses of invested for their purchase (assets) capital. There are no depreciation decrees, because circulating assets are used during the 1 production period and invested capital returns through sale or another the same usage of eventual products. The expenses of the use of capital include:

- Expenses of the use of own capital (alternative expenses) - % rate;
- Expenses of the use of loan capital – percents.

The expenses of capital usage represent the recoupment of part of used capital.

Expenses of work.

Salary of seasonal work force and (fixed) special work force. These expenses are considered as variable costs. It is necessary to calculate the general requirement of seasonal work force at the level of household, but not for certain production process. The latter is more difficult. At the level of certain production process requirement of work force expressed as natural size.

Other fixed work force and domestic work force. Salary of fixed workers not executing special works, belongs to the fixed expenses (or to the indirect expenses) of household, because to attribute them to the certain production process may be only conditionally.

Works done by family members cause alternative expenses (salary rate), but are paid from a profit. Thus, in marginal calculation a requirement of work time is expressed as natural size (man.-hour.).

Other alternative expenses. There are the expenses of areas and fixed assets alternative usage. The alternative expenses of areas and fixed assets usage are calculated basing on estimation of losses of alternative usage (for area – income from alternative production process or leasing, for fixed assets – income from leasing).

7. Thresholds of production and profitability

The calculation of threshold of production and threshold of profitability presupposes the net calculation of expenses per 1 unit, for example, per 1 sign of products.

Threshold of production. The threshold of production presents itself general variable costs per unit of products. The next expenses are considered in calculation:

Variable costs from marginal calculation
other variable costs not accounted in marginal income calculation
percents on circulating assets:

- rate of salary of unpaid work force
- salary of another's work force
- alternative expenses of areas
- other alternative expenses

depending on period, planned investments

Threshold of profitability. The threshold of profitability presents itself the general expenses of every produced units of certain products (average expenses). The next expenses are considered in calculation:

- Variable costs from marginal calculation
- Other variable costs not accounted in marginal income calculation
- Expenses of fixed assets usage (building, machines etc.)

If there is possibility of the alternative use of the fixed assets, then it will be necessary to distinguish next cases:

- Fixed expenses > Alternative expenses (ordinary case)
- It is necessary to use fixed expenses: depreciation decrees, maintenance, percent
- Alternative expenses > Fixed expenses
- It is necessary to use alternative expenses.

- It is nowise impossible to take into account permanent and alternative expenses at the same time.
- Other fixed expenses (for example trade-union payments)

In the example of calculation at the calculation of threshold of profitability for a wheat in a calculation the next partial expenses are included along with variable expenses:

- Fixed expenses of mechanization (depreciation decrees, maintenance, percent);
- Fixed expenses of the special building (granary);
- Other fixed expenses (trade-union payments)

The attributing the partial fixed and indirect costs is initially problematic. The determination of partial fixed expenses of own mechanization is presented in a table 13.

Principles:

a) Calculating of general fixed costs for each machine basing on purchasing price, usage duration and calculated percents.

b) Determination of permanent expenses per every ha or hour for separate operations basing on the annual usage of certain machines and requirements of work time.

c) Aggregation of expenses of separate technological operations.

Interpretation of thresholds of production and profitability.

The thresholds of production and profitability are interpreted as threshold prices, that allow to cover variable or general expenses of production. These indices allow to make grounded decision about the further realization of certain production process: At actual presence of fixed factors, it is necessary to provide the cover of variable costs though. A price must exceed the threshold of production. If production is related to the investments, then expenses of investments (maintenance, use of capital), must be covered.

Thus, the threshold of production, as index, answers a next question: What a price must be on one or another product, to make production of them economic sensually?

The threshold of profitability answers a question: What a price must be on a certain product to get the profit due to its production.

Table. 13. Interpretation of thresholds of production and profitability

	A production makes sense		The profit is got
	without an investment	with an investment *)	
TP < P < TPr	no	no	no
TP < P < TPr	no	yes	no
TP < TPr < P	yes	yes	yes

P - Price (franco-court price);

TP - Threshold of production;

TPr -Threshold of profitability

*) if all permanent factors must be again purchased

8. Recoupment of factors and their productivity

For determination of recoupment of factors through the production process the unit of production process or unit of factor is accepted as estimation unit (DM / man-hour, DM / 100 DM, DM / ha).

The calculation is done the next way:

$$GR - GEeF = \mathrm{Re}cF / QF = \mathrm{Re}cFu,$$

where GR – gain of realization;

GEeF – general expenses except the expenses of factor;

RecF – recoupment of factor per 1 ha;

QF – quantity of factor usage;

RecFu – recoupment of factor per unit of factor.

Productivity of factors. The productivity of factor is the ratio of harvest for certain period (in natural sizes) to the quantity of used to produce it production factor (in natural sizes too). The productivity may be calculated in monetary sizes too. This index is calculated for areas, work, capital factors as a rule.

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THEME 5. FEED CROP PRODUCTION PROCESS

1. Process of feed crop production
2. Variable expenses
3. Marginal income
4. A requirement of the production factors
5. Aspects of marginal calculation
6. Thresholds of production and profitability

1. Process of feed crop production.

1.1. Classification of feed crop production processes.

The production processes of feed crop production are numerous, therefore there is a great number of *criteria of their classification*:

by the landed area:

- Cultivated feed crop production
- Pascual and meadow feed crop production
- Cultivating of intermediate cultures
- Use of side products

by the duration of cultivating:

- One-year cultures
- Perennial cultures
- Perennial meadows and pastures

by the method of the forage usage:

- Pasture of cattle (from an extensive pasture on pastures to intensive pasture on certain areas)
- Mowing on a green feed

by types of forage

- Green feed
- Silage (in different capacities)
- Hay (drying on land, under a roof)

by mechanization and duty cycles

1.2. General questions of feed crop production and improvement of forage.

There are such important tasks in feed crop production:

- receiving of high harvests of nutritives calculating per 1 ha of forage areas;

- production of basic feed with the least expenses and his preservation with minimum losses of dry substance and nourishing energy;
- achievement of the desired productivity of cattle by means of the use maximally possible amounts of basic feed, or, in other words, at minimum expenses of concentrated forage.

It is assisted by:

- high concentration of nutritives in a forage;
- high maintenance of dry substance in silage;
- an increase of assimilating of dry substance by animals.

1.3. Approximate calculation of production of corn on a silo.

Forage is not commodity products so there are no fixed market for sale them. In this connection, the parameters of estimation of forage can come forward: exit of nutritives (for example, StU per 1 ha); quality of forage (concentration of nutritives); seasonality of forage receiving.

The harvest of green crops is estimated on market prices only in the special cases (feed is produced for realization, for example, dry green feed). In this connection, such products are examined as commodity.

In intrahousehold usage there are next variants of feed crop products estimation: calculation the feed balance at the level of enterprise basing on natural sizes (amount of nutritives), deficit is bought and surplus is sold; an estimation by intrahousehold calculation prices.

At determination of exit of nutritives it is necessary to take into account the following:

- at estimation the content of nutritives in a forage it is necessary to take into account dry substance content;

- at the calculation of losses the losses of dry substance and loss of nourishing energies must be differentiated. Losses of nourishing energy, as a rule, higher than losses of dry substance; however both strongly depend on the processes of harvesting and preservation.

- a calculation of net-exit of nourishing energy of feed (table 14).

The calculation of the productivity of feed production is different than for plant growing products. For meadows and pastures used, as a rule, hypothetical (normative) sizes.

Table 14. Calculation of net-exit of nourishing energy of feed

	Green mass, c/ha		Output of DS, c/ha		Green mass, c/ha
*	Content of dry substance (DS), per 1 c	-	Losses of DS, %	*	Content of Nourishing energy (NE) (per 1 c)
		/	Content of DS in forage, per 1 c	-	Losses of PE, %
=	Output of DS, c/ha	=	Output of forage – net, c/ha	=	Output of PE – net,

2. Variable expenses.

Seed. At application of the purchased seed their market value is used in calculations. For seed of own production is used the price plus approximately 20% raise of expenses (storages, drying, preparations of seed to sowing etc). At calculations there are come from a middle amount of necessary for sowing seed. For perennial cultures(for example, Lucerne) the necessary amount of seed is distributed on duration of their cultivation.

Fertilizers. At the calculation of requirement in fertilizers it is necessary to distinguish the biological necessity of plant from economic requirement of fertilizers of economy on the whole. This problem was thoroughly studied in a head "Production of plant growing goods". It is necessary to notice that estimation of nutritives losses from soil for green crops, as a rule, bases on the gross exit of nourishing energy (kg of operating substance per 1000 starched units of energy). Normative data about the bearing-out of nutritives can be used also. Data for calculation are presented in a table 1.

Means of plants protection. The expenses of plants protection (per 1 ha) are estimated by the multiplication the amount of used means (per 1 ha) with the expenses per unit (l, kg). The expenses of bringing of means of plants protection are taken into account at the calculation of variable expenses of mechanization (or at determination of expenses of another's mechanization services). The expenses of treatment of seed (stainsing) are taken into account only in that degree in which they are not taken into account at determination of expenses of seed.

Mechanization of productive process. For determination of variable expenses of mechanization of feed crop production it is possible to use the same principle, that is described in a marginal calculation for winter wheat.

***Other*.** As other expenses in the calculation are presented:

- ensuring of sowing against a hail;
- drying;
- storage, canning, preparation of feed;
- on every 1 m^3 of silo there is 1,40 DM expenses of purchasing of polyethylene and shelter of silos;
- expenses of sale (if they were not subtracted from a market price).

3. Marginal income

Marginal income is a difference between a gross gain of realization and variable expenses of the production of certain type of products. The marginal income for feed crop production process is always negative (on the size of variable costs) because forage is not commodity good and so there is no gain of realization, as a rule.

Subsidizing, in eventual result, can only decrease the size of negative marginal income.

It is thus necessary to take into account the following:

a) taking into account the rule of small agricultural enterprises :

- in case of the use of corn for fattening of bull-calves :
- subsidizing of production of corn is not produced, as a bonus is paid for fattening of bull-calves;
- in case of the use of corn not for fattening of bull-calves :
- subsidizing of production of corn (by rule of small enterprises) is produced.

b) without taking into account the rule of small agricultural enterprises :

- in case of the use of corn for fattening of bull-calves :
- subsidizing of production of corn is not produced, as a bonus is paid for fattening of bull-calves;
- in case of the use of corn not for fattening of bull-calves :
- subsidizing of production of corn is produced.

4. A requirement of the production factors:

A requirement of the landed areas. The requirement of areas at plant growing production processes depends on the vegetation period of certain culture. If an area is used only one time in a year, then a requirement of area of the conducted process is 1 ha. At reusing of one area this size is reducing accordingly. Intermediate cultures and side products do not have a requirement of area, as a rule.

***A requirement of work resources*.** The determination of requirement of work time in the example of calculation is divided into technological operations and periods of work.

***A requirement of circulating assets*.** In the example of calculation requirement of circulating assets (average involved circulating capital) is taken simplified as 60 % of proportional variable expenses.

5. Aspects of marginal calculation

***Proportionally-variable special expenses*.** The proportional variable costs (see p.3) includes also the next: expenses of living and circulating capital; work expenses; alternative costs (for areas, buildings etc.) In exact calculation these expenses with other proportional variable direct costs are subtracted from income. There is no need to do so in practical approximate calculation.

***Differentiation of feed crop production and stock-raising*.** Feed crop production and stock-raising are one economic unit that within the framework of marginal calculation is presented by two different calculations. For differentiation of these industries it is necessary to define, what articles of expenses behave to what industry. In this case it is impossible to use the generally accepted rules, however to application, the following differentiations are offered:

- expenses on forage the franco-field;
- expenses on forage of franco-storehouse;
- expenses on forage franco-feeding-trough.

The following table reflects differentiation of expenses and requirements of feed crop production and stock-raising.

Table 15. Differentiation of expenses and requirements of production resources

Items of expenses, requirement of production factors	Field		Forage storehouse		Feeding-trough	
	FCP	SR	FCP	SR	FCP	SR
Implementation of feed crop production	x		x		x	
Harvesting and transporting of forage		x	x		x	
Storing of forage		x	x		x	
Removal of forage from storehouse		x		x	x	

FCP – feed crop production process; SR - stock-raising production process.

The next rule is used in practice: determined expenses on forage franco-feeding-trough, as exactly in this place all expenses and requirements of production factors are well-organized by reasons of their origin.

6. Thresholds of production and profitability

The calculation of threshold of production and threshold of profitability presupposes the net calculation of expenses per 1 unit, for example, per 1 sign of products. At the example of calculation it is accepted that losses related to area usage as fallow are compensated by subsidies.

Threshold of production. The threshold of production presents itself general variable costs per unit of products. The next expenses are considered in calculation:

-variable costs from marginal calculation
-other variable costs not accounted in marginal income calculation
-expenses of used circulating capital
-rate of salary of unpaid work force (may be 15 DM / hour)
-salary of another's work force
-alternative expenses of areas
-other alternative expenses
depending on period: planned investments.

Threshold of profitability. The threshold of profitability presents itself the general expenses of every produced units of certain products (average expenses per unit of products). The next expenses are considered in calculation:

- Variable costs from marginal calculation
- Other variable costs not accounted in marginal income calculation
- Expenses of fixed assets usage (building, machines etc.)
- Other fixed expenses (for example trade-union payments)

In the example of calculation at the calculation of threshold of profitability for a corn on a silo the next distributed fixed costs are included along with variable expenses:

Fixed expenses of mechanization (depreciation decrees, maintenance, percent);
Fixed expenses of the special building (granary);
Other fixed expenses (trade-union payments);
Distributed indirect costs of enterprise.

The attributing the partial fixed and indirect costs is initially problematic (see “Production of plant growing products, Winter wheat example”).

***Interpretation of thresholds of production and profitability*.** The thresholds of production and profitability interpretation for feed crop production is not important, because the products are used in own production (intrahousehold usage). These sizes are used as an auxiliary instrument of determination and selection of economically preferable processes of production of forage. They allows to estimate the different technological operations in intercommunication with expenses per unit of the produced energy (for example, feed unit, starch unit).

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THEME 6. GENERAL ECONOMIC ASPECTS OF ANIMAL HUSBANDRY GOODS PRODUCTION

1. Meaning and structure of animal husbandry industry
2. Economic bases of animal husbandry

1. Meaning and structure of animal husbandry industry

Economic decisions in area of animal husbandry production submit to the same economic bases as well as plant growing. However, animal husbandry presents the second stage of agricultural production process. It does not need areas directly, but requires them through a requirement of forage.

Systematization of production animals can be produced on the types of animals, on the product, on a form of their maintenance and on other production and technical features. From the economic point of view the significant meaning has a division by the ***criterion of feeding***:

- Ruminant (Bog horned cattle (BHC), sheep) - consuming rough forage - depending on an area
- Monogastric animals (pigs etc.) - high requirements to forage - not depending on an area.

Into industry next distinctions make sense:

- Maintenance of fallopian cattle
- Breeding and weaners of young animals
- Fattening of cattle

The factors of organization of enterprise influenced on the volumes of separate industries of stock-raising and on forms of their maintenance, and resulted in distinct structural changes. As substantial next trends are distinguished: The population of BHC and pigs constantly increased to 80th. Since small reduction is noticeable. For a bird reduction is expressed more notedly. On the contrary the number of cattle-breeders on all types of animals strongly grew short.

The middle quantity of BHC on separate enterprises grew from 17 to 46 heads, pigs from 20 to 99 and birds from 78 to 396.

In German only 10 % cattle-breeders contain 100 and anymore BHC heads, however they are about 43 % from the general population of BHC. For pigs it is possible to fix the following: 7 % pig-breeders have 57 % from a general population. It is possible to notice in general the next progress trend: considerable increase of population on enterprises, with the purpose of rational management and uses of effect of reducing of expenses; growing specialization of stock-raising.

In animal husbandry there was development as well as in a plant growing:

- production and technical indices, such as kg of milk per a cow in a year, day's additional weight, use of forage, improvement of quality of for slaughter carcass etc., were improved by: plant-breeding-technical progress; purposeful and intensive use of assets of enterprise.
- also application of labour and capital became better per unit of animal by: new forms of maintenance; increasing population of cattle (reducing of busy workers in a process).

This development notedly changed not only efficiency into the same industry but also between separate industries of production.

There is common development of animal's productivity on the example of development of the productivity of milky cow.

Table 16. Development of productivity of cow per a year in Germany

Indicator	Unit	1980	1990	1994	Rate of height per a year	
					(80-90)	(90-94)
Yield	kg/per a cow	5183	5897	6101	0,013	0,009
Fatness	%	3,92	4,15	4,21	0,006	0,004
Exit of fat	kg	203	245	257	0,019	0,012

The improvement of the productivity is noticeable on all types of animals. For example 700 g. of average daily additional weight on fattening of pigs at the beginning of 80th was the higher productivity. To the middle of 90th it is a middle index only. Today cattle-breeders seek to get 800g and more. The improvement of the productivity in the pig breeding is got not only due to the indicated indices, so as reduction of fattening period is here taken into account in a great deal only, while decline of requirement of forage (got value: usage of feed < 1: 3) and improvement of for slaughter cattle are regardless. Too same operates for other kinds of fattening animals. A production and technical improvement was accompanied by the different change of price on a product.

From a picture it is possible to notice next tendencies:

- In a period from 1970 to 1980 it is possible to mark a considerable price rising on all produces.
- Price on milk to beginning of 90th developed comparatively favourably, that in a great deal depends on EU orders about milk and by the related to it quota.

- With beginning of 90th it is noticeable nominal price-cutting on all products.

Development of expenses. At the structure of expenses of animal husbandry production a large role is played by expenses of forage, expenses of repair of herd, technical equipment, inlaid capital and labour. These expenses depend on prices on the factors of production.

High increasing of cost of labour as a factor of production foremost influenced on those cattle-breeders that in spite of high expenses on a technical equipment needed relatively great numbers of labour. It on a greater measure touches dairy cattle breeding, while on fattening of pigs and birds by means of introduction of new technique expenses of labour to retain at one level.

In the use of labour, dairy cattle breeding is less preferable than not depending on areas industries.

2. Economic bases of animal husbandry

Tasks of productive animal husbandry. From the economic point of view organization of the one or a few industries of useful animals within the framework of program of production is directed to increase the result of enterprise at long-term period by:

- transformation of uncommodity forage that on an enterprise arise up as main or side product, into commodity animal husbandry products (use of income),
- use of the sold and bought in forage, until the net income of usage is higher than selling or purchase price (improvement of income)
- productive use of free resources of labour and capital or
- supposing that animal husbandry brings by supplying of organic fertilizers with an aim to support or to improve the soils fertility.

Determinatives of kind and volume of productivity of animal husbandry. Kinds, volumes and organizational forms of maintenance of animals differ on different enterprises and in different regions. The determinatives are the following:

- Climatic and economic location,
- Production and personal relations,
- Economy development with a changing production and technical, market and legal relations.

Climatic and economic location. Climatic terms influence directly on a volume and organization of stock-raising through the production of rough forage of

different kind and quality, and by implication through influence on organization of enterprise. Use of absolute increase of green areas and arable land may be only at presence of weed-eaters. Because BHC in general better than sheep uses rough forage and different groups of BHC require the feed of different quality, meadow, pasture and forage on arable land with high harvests serve preferably to milk and meat cattle breeding. Valueless areas are used for a young animals, fallopian population and sheep. Increase of not depending on areas cattle breeding does not depend on climatic terms; it is determined in a greater degree by economic terms and profitability.

Production and personal relations.

There are the next important points:

Labour intensive processes (e.g. milky cows) in relation to the use of areas are more preferable than extensive processes (fattening of BHC, growing of heifers); in relation to the productivity it is vice versa. Consequently, enterprises with small areas with the relatively high resources of labour prefer the milky cattle breeding, in that time as at insufficient labour resources, fattening and growing of young animals are accepted. Similar relations exist in the pig breeding. The maintenance of sows requires, relatively to general sum of marginal income, plenty of labour at small usage of capital in comparison with fattening of pigs.

Present building and capital influence on organization and volume of stock-raising at expansion and rationalization.

At forms of animal husbandry change it is necessary to take into account the liquidity and stability of enterprise for a risk assessment, even if measures seem effective.

Legal terms influence on the volume of animal husbandry also. So for example enterprises with very high concentration of animals can be excluded from the programs of supports, or expansion of production may be limited.

Personal readiness to regular and actual work, abandonment from vacations and spare time on a weekend, the personal propensity to the stock-raising are the pre-conditions to success also.

General economy development. The development of animal husbandry depends on the level and habits of feed, demand on products. For the last 10 years:

Share of expenses on the feed from 1970 went down very. Household (4 persons, average level of income) expended for feed in 1970 - 27% and in 1994 - 16% of income.

Development of consumption in general is marked by a decline and considerable slump of consumption of meat and fresh fruit. It is brightly shown in the consumption of beef.

Problems of ecology related to the animal husbandry production are discussed in society. Environment protection measures lead to additional expenses. These expenses influence into profitability and competitiveness of animal husbandry negatively.

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THEME 7. DAIRY CATTLE BREEDING

1. General remarks
2. Value of the produced commodity goods
3. Variable expenses
4. Marginal income
5. The requirement of production factors
6. Aspects of marginal calculation.
7. Threshold of production and threshold of profitability

1. General remarks.

The dairy cattle breeding in an agricultural enterprise cannot be examined independently from other production processes:

- a dairy cattle consumes the forage produced by feed crop production industry;
- for utilization of the got organic fertilizers the enterprise, as a rule, needed own areas;
- the litter got from dairy cows can be used for intra-household aims;
- heifers can be used for repair of basic herd.

Coming from the above-mentioned intra-household relationships, there is the necessity to differentiate the dairy cattle breeding from other production processes clearly.

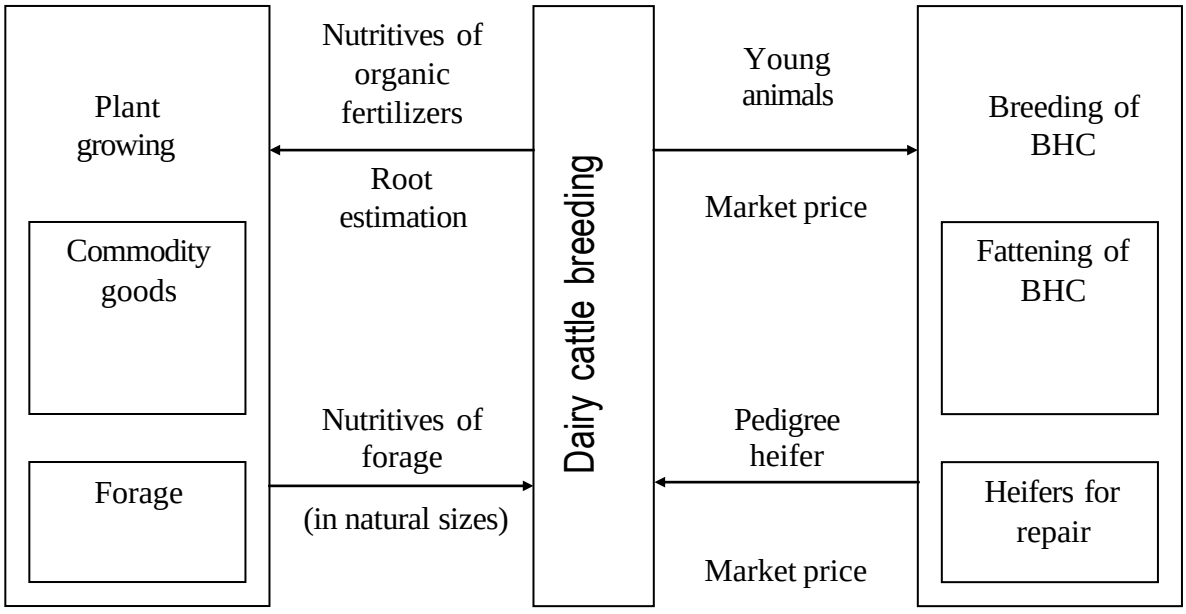

Fig. 7. Differentiation of the dairy cattle breeding from other production processes.

These intercommunications in more detail are examined in the stated below example. It is necessary to spare special attention to aggregating of the milky cattle breeding and feed crop production.

2. Value of the produced commodity goods.

The value of the produced commodity products in the dairy cattle breeding include:

- milk;
- cattle for slaughter;
- litter;
- organic fertilizers (at methodically actual marginal income calculation only for the intra-household usage).

2.1. Produced milk.

Value of the produced commodity milk (VCM) is calculated as follows:

$$VCM = GPcow * APmilk ,$$

where GPcow - the general annual productivity of cow (kg);
APmilk – the average price of 1 kg of milk.

Under the general productivity of cow is implied:
- the milk sold to milk manufactures;
- other realization of milk;
- a self-consumption;
- the milk fed to the litter (the equivalent amount of milk in a money form is reflected in marginal calculation of income of fattening of BHC).

If the annual productivity (GPcow) must be certain on the basis of lactational productivity (LP) of cow, then a re-calculation will be done taking into account an intercalving period:

GPcow = LP(365 days / intercalving period, days)*

An average price depends on milk content of fat and protein, and also from its qualitative criteria (content of microorganisms and antibiotics).

2.2. Litter.

Amount of litter, that can be realized calculating per one cow in a year, is determined on basis:

- amounts of born calves calculating per a cow and year;
- loss of young animals (up to it realization).

Amount of the got litter calculating per one cow and year is determined the next way:

Amount of the got litter = 365 days / intercalving period, days

If the average amount of the born litter per a 1 cow in a year is known, then by means of above-mentioned formula it is possible to determine the duration of intercalving period :

Duration of intercalving period = 365 days / amount of born calves per 1 cow in a year

The value of litter is based on the average prices of heifers and bull-calves.

In practice, litter is estimated by its market price (as for own usage, so for sale). That's why, variable costs of a calf (own produced), at the calculation of marginal income of production process "Fattening of BHC", are presented in size of its market price.

Realization weight of calf is more advantageously to orient on living mass of animals, usually realized at the market (as a rule, 80 - 90 kg).

Grow of young animals of BHC can be examined as a separate production process.

2.3. Cattle for slaughter.

The value of for slaughter cow is determined on basis:

- average term of its use;
- loss of cattle;
- prices of a beef.

Coming from the average term of the use of cow, it is possible to define the average percent of culling of population (repair of herd). If the loss of cattle is not considered, then amount of sold old cows will equal the population of new heifers entered to a basic herd.

At the account of loss of cattle (natural death, force slaughter) a calculation is done as follows:

Repair of herd in a year	*0,250 heads*	*25,00%*
- Loss of cattle	*0,010 heads*	*1,00%*
= For slaughter cattle	*0,240 heads*	*24,00%*

A level of culling of population is a size reverse to the term of the use (years).

2.4. Organic fertilizers.

The value of organic fertilizers is estimated on the basis of value of equivalent amount of operating substance (OS/PS) of mineral fertilizers.

Assimilating of nitrogen (N) foremost depends on technology and terms of its bringing (a period of plants vegetation is a winter). In calculation the assimilating is 40 - 50%. Assimilating of phosphorus (P_2O_5) and potassium (K_2O) is equal 100%.

The mastered operating substance is estimated on prices of OS of mineral fertilizers.

Content of OS in organic fertilizers, and also got amount of organic, calculating on 500 kg of living weight of cattle, can be got from special literature.

3. Variable expenses.

To the variable expenses of the dairy cattle breeding belong, as a rule:

- the expenses related to repair of basic population;
- the expenses related to growing of young animals up to realization;
- expenses of forage;
- variable expenses of mechanization of production process;
- other variable expenses (for example: veterinary, insemination, water, electricity, control of the milky productivity of cow etc.).

The work expenses will be calculated only if they are well-known exactly, and if the production process is realized completely. The latter means that the amount of workers of this production process is well-known.

The requirement of work time of familiar workers and other permanent workers is not accounted in marginal calculation, but is considered as fixed costs.

3.1. Repair of herd.

The annual percent of animals of herd culling depends on average duration of usage of cattle:

$$ACA = \frac{1}{UDcow},$$

where ACA – annual percent of culling of animals;
UDcow – duration of cow usage, years.

If the term of the use of cow depends on the amount of lactations, then at a calculation of annual percent of culling of population it is necessary to take into account the intercalving period.

$$ACA = \frac{1}{UDlact} * \frac{365}{IcD},$$

where ACA – annual percent of culling of animals;
UDlact – duration of cow usage, lactation;
IcD – intercalving period, days.

Like this calculation the annual expenses related to repair of basic herd of cows are determined.

For replacement of culling population the market value of pedigree heifer undertakes in calculations. If heifer used for repair of herd is own grown, then expenses of its purchase in the marginal calculation of income (MCI) of the dairy cattle breeding must coincide with it value at MCI "Growing of young animals for repair".

3.2. Expenses of forage production.

Commodity forage. The forage, which can be saled, are estimated on the market prices. It means that the own production forage in marginal income calculations is estimated on the same prices.

Basic forage of own production. The expenses of own production of basic forage don't relate to variable expenses of stock-raising processes.

Except for the case, when the feed crop production incomes have been accounted in relative marginal income calculations already (by pay-sheet prices) So,

the expenses of basic forage production must be calculated at marginal calculations in stock-raising.

The incomes of feed crop productions are not estimated as a rule. The feed crop production expenses are considered as cattle breeding expenses only owing to aggregation of feed crop and stock-raising production.

Forage requirement. The requirements of basic or concentrate forage are estimated basing on the feed ration. The requirement of nourishing substances for 1 cow depends on:

- live mass of animal;
- dairy productivity;
- content of ingredients in milk (fat, protein etc.);
- stage of calving;
- motion and activity of animal;

and is divided into:

- requirement for vital functions support;
- requirement for milky productivity of cow.

Table 17. Norms of BHC requirement of nutritives from forage.

Vital functions support	Energy	0,293	mJ/kg of MAM per a day
	Protein	3,900	a g / kg of MAM per a day
Milk productivity	Energy	0,380	mJ/% fat in 1 kg of milk
	+	0,210	mJ/% protein in 1 kg of milk
	+	0,950	mJ/kg of milk
	Protein	25,000	g /% protein in 1 kg of milk
Calving	Energy	0,100	mJ/kg of MAM per a day
	Protein	4,200	a g /kg of MAM per a day
Motion	Horizontal	0,0034	mJ/kg of living mass per a 1 kilometre
	Vertical	0,000036	mJ/kg of living weight per a 1 kilometre

There is the necessity to calculate the ration of feeding for determination of basic and concentrate forage part of ration.

Necessity amount of concentrative forage is determined on the basis of the productivity of the cow received less from feeding of basic feed. Amount got from 1 kg of the concentrated forage of milk equal 1.8 - 2.2 kg. Using the tables of nourishing value of forage, where components of every type of the concentrated feed are described, it is possible to determine the general exit of nutritives.

The basic forage requirement is calculated as difference between the general requirement of nourishing substances and their maintenance in concentrative forage. There is the necessity to take into account the feeding losses.

General requirement of nourishing substances
− Content of nourishing substances in concentrative forage
= The requirement of nourishing substances (NS) from basic forage (net)
+ feeding losses (10%)
= *The requirement of nourishing substances (NS) from basic forage (gross)*

3.3. Variable expenses of mechanization of production.

In the dairy cattle breeding to the variable expenses of own mechanization belongs the stated below machines and equipment usage expenses:

- Milking technique (milk line, milking setting)
- Ventilation
- Cooling of milk
- Grade and mixing of forage (flattening)
- Bringing liquid (hard) organic fertilizers (incl. variable expenses of tractor)
- Machines for feeding of cattle (if they are not attributed directly to feed crop production)

A silo loader + tractor
A cattle-feeder + tractor
Delivery of green feed

At determination of variable expenses of mechanization it is necessary to define the point of feed crop production and stock-raising differentiation.

In this connection, bringing of organic belongs to the expenses of stock-raising, and expenses of storage and warehousing of forage - to feed crop production.

3.4. Other variable expenses.

- Veterinary. To define expenses on medicines and services of veterinary doctor calculating per a 1 cow in a year, there is needed to calculate the total annual expenses on this item for all cows and to divide the result into the average annual population of basic herd of cows.

- Water, electricity.

- Insemination, control of the milky productivity of cow.

4. Marginal income.

Basing on definition, marginal income is calculated as difference between the gain of realization and direct variable costs. Marginal income calculating per 1 MJ of nourishing energy of basic forage gives the information about its further usage.

The marginal income per 1 man-hour means nothing, it may be used as benefit indicator in aggregation with feed crop production.

5. The requirement of production factors

5.1. The requirement of area

The requirement of area arises relatively on the own forage production. The requirement of areas can be estimated owing to aggregation of feed crop production and stock-raising.

5.2. The requirement of labour

The requirement of work force in calculation depends on herd size, condition of animal keeping, production development level. If the maintenance of animals is whole year basing on silage, so there is the dividing into winter and summer feeding periods. The requirement of work for unusual work operations is given in special literature.

5.3. A requirement is in a living and circulating capital.

The requirement of living and circulating capital simplified equated with the initial value of one cow. It was set that the current variable expenses of maintenance of animal can be covered by gain of realization of produced milk.

6. Aspects of marginal calculation.

6.1. Proportional variable direct costs

The proportional variable costs includes also the next:

- Percents of living and circulating capital
- Work expenses
- Alternative costs (for areas, buildings etc.)

In exact calculation these expenses with other proportional variable direct costs are subtracted from income. There is no need to do so in practical approximate calculation.

6.2. The aggregation of feed crop production and stock-raising

The aggregation of feed crop production and stock-raising allows:

- ✓ to determine the expenses and requirement of factors for basic forage per 1 cow;
- ✓ to use the basic forage expenses in marginal income calculation of milky cattle breeding;
- ✓ to compare economic efficiency of realization and processing of goods or to compare various directions of stock-raising industry.

Aggregating methodology:

1) the major indices of the dairy cattle breeding are written off (marginal income, necessity and presence of forage etc.);

2) requirement of forage is designated by the negative sign "-", presence of forage - by a sign "+";

3) a requirement of landed area calculating per a 1 cow is determined on the basis of requirement of animal in a basic feed and productivity of 1 ha of forage lands;

4) on the certain landed area, additionally variable expenses of milk production lie down;

5) requirements of living and circulating capital, work time for the production of basic forage are calculated properly (proportionally) and are added up with the corresponding indices of production process the "Dairy cattle breeding".

Recommended literature.

1. Richard E. Just. Mathematical modelling in agricultural economics / Richard E. Just., University of Maryland, USA, 10 p.

2. Agricultural systems – case studies: economics, technology and diversity / Oliver W. Castalonge [edit.], Nova science publisher, NY, 2008.

3. The Benefits from agricultural research and development, innovation and productivity growth / Alston, J. //OECD Food, Agriculture and Fisheries Working Papers, 2010

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THEME 8. BREEDING AND FATTENING OF BIG HORNED CATTLE (PEDIGREE HEIFERS AND FATTENING BULLS)

1. General remarks
2. The gain of realization
3. Marginal income
4. The requirement of production factors
5. The aspects of marginal income calculation
6. The thresholds of production and profitability
7. The productivity and recoupment of used production factors

1. General remarks

The production process of big horned cattle breeding is the same to the milky cattle breeding. It means that big horned cattle breeding process requires basic forage of own production. It leads to the necessity of dividing production process into such as feed crop production and cattle keeping (see 1.1 of "Dairy cattle breeding").

The main feature of big horned cattle breeding is the duration of production process. The duration of it is more than 1 year as a rule. So the all expenses and requirements, which related to this process, are taken into account. The marginal calculation is formed depending on head of cattle, but not 1 cow per year in average.

For example, the process of heifers breeding was made once completely. So, it means:

- during the one period (for example, 2 years) there are breeded 2 head of cattle in average,

- the 1 animal may be sailed annually in average (except for loss of cattle).

The advantage of such calculation is the possibility to use the data for recounting per year or half-year.

If the duration of production process is less than 1 year (fattening), then the place of cattle indicator will be used also to make calculation more easily.

2. The gain of realization

There are the factors, considered in calculation of the gain of realization of big horned cattle production process:

- ✓ products of high pedigree animals
- ✓ part of unpedigree animals

- ✓ loss of cattle during the breeding period
- ✓ organic fertilizers (exact marginal calculation of income/ intraindustry output)

There are the factors, considered in calculation of the gain of realization of big horned cattle fattening production process:

- ✓ products of fattening bulls
- ✓ loss of cattle during the fattening period
- ✓ organic fertilizers

2.1. The pedigree heifers breeding

The quantity of pedigree heifer received from pedigree calves may be differ depending on selection, lower productivity indices, loss of cattle etc. for example:

0,9 pedigree calf – 2,0 % loss =0,882 pedigree calf

1 pedigree calf 0,1 calf for slaughter – 2,0 % loss = 0,098 calf for slaughter

All animals are estimated bases on market price, independently of the aim of their usage (sale, herd repair).

2.2. The bulls fattening

There is the distribution of bulls realization into live or slaughter mass.

Live mass realization:

The amount of fattening calves 1 piece
– loss during the fattening period 0,02 piece
= amount of fattened bulls 0,98 piece
x realization mass (= end weight - losses) 620 kg
= realized meat (live mass) 607,6 kg
x price 1 kg of live mass 3,55 DM/kg
= gain of meat realization 2156,98 DM

Slaughter mass realization:

The amount of fattening calves 1 piece
– loss during the fattening period 0,02 piece
= amount of fattened bulls 0,98 piece
x end weight 652,6315789 kg
x after slaughter output (%) 56 %
= realized meat (live mass) 365,4736842 kg
x price 1 kg of slaughter mass 5,9 DM/kg
= gain of meat realization 2156,294737 DM

2.3. The organic fertilizers

The value of fertilizers is calculated basing on the equivalent of mineral fertilizers, expressed in net output of nourishing substances (NON). The assimilated nourishing substances are estimated basing on the prices of NON as mineral fertilizers. The maintenance of nourishing substances and their requirements may be received from special literature.

2.4. The bonus for beef

The bonus for bulls fattening must be included to the gain of realization completely. The bonus for area isn't included to the gain of realization at silage maize production for bulls fattening.

3. Variable costs

The variable costs of cattle breeding production process include, as a rule:

- herd repair expenses,
- forage production expenses
- variable costs of mechanization and
- other variable costs (veterinarian, insemination etc.)

The work expenses will be calculated only if they are well-known exactly, and if the production process is realized completely. The latter means that the amount of workers of this production process is well-known. The requirement of work time of familiar workers and other permanent workers is not accounted in marginal calculation, but is considered as fixed costs.

The Herd repair. The herd repair expenses presents themselves the price of calf, independently the source of calf purchasing (own production or purchase). If the herd repair animals are received from own production, the value of them will be considered as the gain of realization of milky cattle breeding production process.

The forage production expenses.

Commodity forage. The forage, which can be saled, are estimated on the market prices. It means that the own production forage in marginal income calculations is estimated on the same prices.

Basic forage of own production. The expenses of own production of basic forage don't relate to expenses of stock-raising processes. Except for the case, when the feed crop production incomes have been accounted in relative marginal income calculations already (by pay-sheet prices) So, the expenses of basic forage production

must be calculated at marginal calculations in stock-raising. The incomes of feed crop productions are not estimated as a rule. The feed crop production expenses are considered as cattle breeding expenses only owing to aggregation of feed crop and stock-raising production.

Forage requirement. The requirements of basic or concentrate forage are estimated basing on the feed ration. The requirement of nourishing substances for 1 head of cattle depends on:

- live mass of animal; The requirement is estimated basing on the average live mass of animal and average requirement.
- accreation of live mass during the breeding period; The requirement per 1 kg of live mass accreation increases during the breeding period. So the requirement calculation must be divided depending on periods of breeding. There was used an average requirement for example.
- the requirements for cows with calves. The requirements of nourishing substances for cows with calves are estimated for pedigree heifers only, so loss of cattle and slaughter are considered.
- motion

The requirement of nourishing substances is divided on:

- The requirement of vital functions support
- The requirement of meat productivity (accreation of live mass, motion)

In practice the requirement of energy for heifers is determined by MJ net energy and for fattening bulls by starch unit (StU). The norms of requirements are determined in accordance with Kchirgsner.

There is the necessity to calculate the ration of feeding for determination of basic and concentrate forage part of ration. The necessary quantity of concentrate forage is calculated basing on requirement of nourishing substances and their maintenance in concentrate forage. The basic forage requirement is calculated as difference between the general requirement of nourishing substances and their maintenance in basic forage. There is the necessity to take into account the feeding losses.

Table 18. The norms of requirement of nourishing substances for big horned cattle

			Pedigree heifers	Fattening bulls
Vital functions requirement	Energy	per kg MAM /day	0.293 mJ net energy	28.3 StU
	Protein	per kg MAM /day	3.9 g	3.9 g
Accreation of live mass	Energy	per kg of additional weight	22.8 mJ net energy	2120 StU
	Protein	per kg of additional weight	625 g	425 g
Calving period	Energy	per kg MAM /day	0.1 mJ net energy	
	Protein	per kg MAM /day	4.2 g	
Motion (only energy)	Energy	per kg LM /km	0.0034 mJ net energy	0.263 StU
	Protein	per kg LM /km	0.000036 mJ net energy	0.0029 StU

LM - live mass, kg; MAM - metabolic mass of animal (= l.m. 0.75).

General requirement of nourishing substances
- Maintenance of nourishing substances in basic forage
= The requirement of nourishing substances (NS) from basic forage (net)
+ feeding losses (10%)
= The requirement of nourishing substances (NS) from basic forage (general)

The variable costs of mechanization. The usage of various technique leads to origin of variable costs of mechanization (theme 3.3 of Dairy cattle breeding description).

The other variable costs.

− *Veterinarian*. The calculation of veterinarian expenses bases on general expenses for herd per year:

General expenses for herd (veterinarian)
/ average annual amount of cattle
x amount of animal
= veterinarian services per 1 head of cattle

- *Water, electricity*. There is the necessity to use norm of water and electricity usage (special literature)

-*Insemination*.

4. Marginal income

Basing on definition, marginal income is calculated as difference between the gain of realization and direct variable costs. Marginal income per MJ/StU of basic forage means their usage. The marginal income per 1 man-hour means nothing, it may be used as benefit indicator in aggregation with feed crop production .

5. The requirement of production factors

The requirement of area arises relatively on the own forage production. The requirement of areas can be estimated owing to aggregation of feed crop production and stock-raising. The requirement of work force in calculation depends on herd size, condition of animal keeping, production development level. If the maintenance of animals is whole year basing on silage, so there is the dividing into winter and summer feeding periods. The requirement of work for unusual work operations is given in special literature.

The determination of living and circulating assets is difficult in this production process because: if the duration of breeding period is more than 1 year, the requirement of capital will be calculated for more amount of animals. the method of exact requirement of basic forage and labour for estimation capital requirement can be determined for certain case only.

The requirement of capital arises partially during the period (year). For example, the requirement of capital for circulating assets may be calculated reductive the next way:

Expenses of herd renovation (1 calf)

+ 50% of sum of all other variable costs

x amount of animals

= The requirement of capital for living and circulating assets

6. The aspects of marginal income calculation

The proportional variable costs (see p.3) includes also the next:

Percents of living and circulating capital

work expenses

· Alternative costs (for areas, buildings etc.)

In exact calculation these expenses with other proportional variable direct costs are subtracted from income. There is no need to do so in practical approximate calculation.

The aggregation of feed crop production and stock-raising allows:

- ·to determine the expenses and requirement of factors for basic forage per 1 head
- ·to determine the basic forage expenses in marginal income calculation
- ·to compare economic efficiency of realization and processing of goods or
- to compare various directions of stock-raising industry

7. The thresholds of production and profitability

The calculation of threshold of production and threshold of profitability presupposes the net calculation of expenses per 1 unit, for example, per 1 sign of products.

The cattle breeding process is related with production of basic (pedigree cattle) and side products (organic fertilizers). So the calculation of variable costs of basic goods production requires to subtract of side products income from sum of variable costs.

The threshold of production presents itself general variable costs per unit of products (DM / kg of meat). The next expenses are considered in calculation:

- other variable costs not accounted in marginal income calculation
- variable costs of basic forage production (from aggregation)
- percents on circulating assets (stock-raising and feed crop production)
- rate of salary of unpaid work force
- (stock-raising and feed crop production) (may be 15 DM / hour)
- Salary of another's work force (stock-raising and feed crop production)
- alternative expenses of areas under fodder crops usage (from aggregation)
- other alternative expenses (buildings for animal)
- depending on period: planned investments

If the basic forage production expenses are not determined by aggregation, they may be accounted the next way:

- The determination of thresholds of production and profitability for each feed crop production process independently;
- the determination of average expenses of ration forage;

- the multiplication of expenses of production of 1 MJ to general requirement of cow in basic forage (approximate calculation (= Threshold of production III) or exactly for each position).
- The threshold of profitability presents itself the general sum of expenses per products unit (DM/kg of milk = average expenses of production of products unit). The next items of expenses are used in calculation:
- variable costs, shown in marginal calculation;
- other variable costs, not accounted in marginal calculation the expenses of fixed assets usage.
- distributed fixed costs of basic forage production
- other fixed costs.

These indicators are interpreted as marginal prices of product. So it means:

- if the market price is more than threshold of production III, the production is advantagable in medium term period;
- The investment into the industry will be advisable, if the additional (fixed) expenses of production is lower than difference between price of product and threshold of production III;
- The production is unprofit, because the price of product is lower than Threshold of profitability;

8. The productivity and recoupment of used production factors

See "Plant growing goods production" t.7

The recoupment of production factors presents itself their implementation during the production process. The productivity of production factors expresses correlation between volume of output and volume of input of certain period. The calculation bases on natural sizes. Such indicators as work productivity and areas productivity are important in estimation of bulls fattening production process.

Recommended literature.

1. Richard E. Just. Mathematical modelling in agricultural economics / Richard E. Just., University of Maryland, USA, 10 p.
2. Agricultural systems – case studies: economics, technology and diversity / Oliver W. Castalonge [edit.], Nova science publisher, NY, 2008.
3. The Benefits from agricultural research and development, innovation and productivity growth / Alston, J. //OECD Food, Agriculture and Fisheries Working Papers, 2010

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6. Mathematical programming for agricultural, environment and resource economics / Harry M. Kaiser, Kent D. Messer, University of Delaware, USA, 2011.

THEME 9. PEDIGREE PIGS BREEDING

1. General remarks
2. Value of output
3. Variable costs
4. Marginal income
5. Requirement of production factors
6. Other aspects of marginal calculation
7. Threshold of production and profitability
8. Productivity and recoupment of used production factor

1. General remarks

For the determination of certain production process in stock-raising the next information is significant:

– sign and breed of animal;

– the maintenance form (feeding, average annual quantity and amount of animal rotation);

– basic production indices (for example: productivity, quality, nutritives content);

– the forms of products usage (realization, processing, herd repair);

– inputs (for example: forage, young animals for herd repair, insurance, work);

– commodity goods prices and production assets;

– technique (types, expenses).

Inspite of production process of BHC maintenance, pedigree pig breeding does not depend on basic forage production and relatively on agricultural areas as a rule. The areas are needed for produced by industry manure utilization, but it is possible to sale the manure other enterprises.

The unit of production process "Pedigree pigs breeding" estimation is maintenance of 1 sow per year. This includes some farrows on a year, as a rule. The dividing of production processes of pigs fattening and pigs growing is in the point where there is the real market price for pig, achieved certain weight (25-30 kg). This price is the objective bases of pig value estimation.

It means that in pigs growing process all expenses of pig growing made before are attributed to sow. If the pig is not sold and grown further, so the expenses from this moment will be attributed to the process "Pigs fattening". That's why, the relatively economic preferability of production processes of pigs growing and pigs fattening may be calculated more exactly.

The economic efficiency of pigs growing and the list of necessary production technique are depending on:

– types of maintenance of suckling and farrowed sows;

– suckling period duration;

– maintenance of pigs for realization;

– used forage and forage technique.

2. Value of output

The value of output at basic heads of pig maintenance includes:

– received animals;

– slaughter weight of basic animals;

– organic fertilizers (at methodically right marginal income calculation only for own usage)

Quantity of grown pigs per 1 sow on a year is calculated as multiplication of amount of pigs from 1 farrow and average annual farrows amount except for loss. The price of pig (25 kg) is calculated the next way:

Basic price of 20 kg of pig – 95,00 DM/head.

+ Addition for each additional kg of weight – 2,50 DM/кг x 5 кг 12,50 DM/head.

+ Value added tax – 9% от 107,50 DM 9,68 DM/head.

= Current value – 117,18 DM/head.

Value of saled slaughter animals depends on:

– average duration of basic sows usage;

– loss of cattle;

– meat price.

The indicator of average duration of sows usage shows, how much of basic animals must be defected in average (the basic herd repair). If the loss of cattle is not taken into account, so the amount of defected old sows and amount of new young sows will be the same. Taking into account the loss of cattle the calculation is the next:

Herd repair on a year 0,400 head./ unit of estimation 40,0%

– Loss of cattle 0,020 head./ unit of estimation 2,0%

= Slaughter head on a year 0,380 head./ unit of estimation 38,0%

The herd repair is the size against of sow usage duration (year).

Uncommodity goods, for example, manure of pig, in methodically right calculations must be given only in natural sizes. But in given example, organic fertilizers are estimated and their value is added to general value of produced goods.

The value of organic fertilizers is estimated basing on the value of equivalent amount of processing substance (PS) of mineral fertilizers. While calculating the quantity of produced organic fertilizers it is supposed that one conditional head (500 kg of living weight) produces 18 m3 of liquid manure with maintenance of dry substance 7,5 %. The maintenance of PS in manure of various animals and organic output per 1 conditional head of cattle is given in agricultural literature. The assimilating of organic nitrogen degree depends on technique and terms of fertilizers usage (vegetative period is winter) first of all. In practical the assimilating is brought at level of 40- 50% maximum. The phosphor and kalium are assimilated 100%. The PS of organic fertilizers, left in soil, is estimated basing on the value of PS of mineral fertilizers.

3. Variable costs

The variable costs of pedigree pigs maintenance include, as a rule:

– expenses of basic herd repair;

– expenses of pigs growing before realization weight (or before the start of its own usage).

– forage expenses;

– expenses of process mechanization;

– other variable costs (veterinarian, insemination, water, electricity, realization).

Work expenses are estimated only, if salary may be directly attributed to certain implemented production process. It means that work is attributed to this production process realization. The calculation of fixed work requirement in marginal calculation is not done and is given as fixed factor.

Annual percent of basic animal defection depends on average duration of sows usage:

Annual percent of basic animal defection = 1 / Duration of sow usage, years.

If the sow usage duration is determined by amount of farrows, so there will be the need to to take into account the annual average amount of farrows.

$$\text{Annual percent of animal defection} = \frac{\text{Usage duration, farrows}}{\text{Annual average amount of farrows}}$$

In the given example the basic sows usage duration is given in years. So, the defection level is:

Annual percent of animal defection = 1 / 2,5 farrow

It means that per 1 sow on a year must be defected 0,4 animal. This indicator is the bases of basic herd repair expenses. For the herd repair the high pedigree young sows are used. Their value is determined by current market price.

In the case of basic forage usage it is necessary to use the methodic given in "Milky cattle breeding". Basic forage are not estimated, but are taken into account in marginal calculations in natural sizes as a requirement of forage assets.

Feed ration is estimated by market prices on feed components independently from origin of purchasing (own production or purchasing). The expenses of cutting and shaking off are added to named before. They may be accounted as variable expenses of mechanization.

The variable expenses of mechanization are attributed to stock-raising products.

Other variable costs.

– Insemination

– Veterinarian, medicines, all payments for veterinarian, medicines, disinfection etc.

– Water, electricity. In practice the norm data is used from special literature

– Control, insurance

– Realization costs

Costs of transportation and transport insurance (if the custom doesn't pay their as the additions for pig value)

expenses of slaughter sows sale.

– Other (not accounted in other items, for example, work clothes).

4. Marginal income.

The marginal income is calculated as difference between commodity goods value and variable direct costs of their production. The market value of pig has the most influence on marginal income. It may change depending on meat price.

5. Requirement of production factors

In the given example the requirement of living and circulating capital is equal to repair sow price and additionally + 25 % forage expenses. It is supposed that other expenses will be covered by the gain of realization.

The requirement of work time per 1 sow depends on the basic herd size, system of maintenance and level of animal productivity. In practice the normative data are used as a rule.

6. Other aspects of marginal calculation

The next proportional - variable direct costs are calculated to:

– expenses of using living and circulating capital;

– work expenses;

– alternative expenses (buildings, areas etc).

To determine the objective marginal income the value of output must be reduced on the proportional variable direct costs.

7. Threshold of production and profitability.

The calculation of threshold of production and threshold of profitability presupposes the net calculation of expenses per 1 unit, for example, per 1 sign of products.

The cattle breeding process is related with production of basic (pedigree cattle) and side products (organic fertilizers) So the calculation of variable costs of basic goods production requires to subtract of side products income from sum of variable costs.

The main product of pedigree pig breeding is 1 pig. The side products are slaughtered cattle and manure. The value of side products is subtracted from general sum of variable costs.

The threshold of production presents itself general variable costs per unit of products (DM / kg of meat). The next expenses are considered in calculation:

- variable costsaccounted in marginal income calculation

– subtracting the value of organic fertilizers (side products);

– subtracting the value of slaughter sow

- other variable costs not accounted in marginal income calculation

– expenses of living and circulating capital usage;

– salary rate for unpaid work (the alternative usage of work is possible for 15 DM/hour);

– salary of work;

– other alternative expenses (fixed assets usage);

– depending on time: expenses of planned investments.

The threshold of profitability presents itself the sum of expenses per unit of basic goods. This indicator allows to determine the long-term minimal level of price (cover of general sum of expenses) There are the next items of expenses used in calculation:

– variable costs, shown in marginal calculation;

– except for organic fertilizers value (side products) and value of

– slaughter animal meat (old sow);

– all other variable costs, not accounted in marginal calculation (for example, expenses of work force and circulating capital usage etc);

– expenses of fixed assets exploitation (fixed costs);

If the alternative usage of fixed assets is possible so there will be the next ways to determine expenses:

– Fixed costs of alternative costs (As a rule!)

The fixed expenses such as depreciations, maintenance, capital usage expenses are taken into account.

– Fixed costs of alternative costs (As a rule!). The alternative expenses are taken into account. The one time taking into account the alternative and fixed expenses of fixed costs is wrong.

– Other fixed and indirect expenses. Fixed expenses of buildings, constructions and technique usage include:

– Depreciations (capital usage). The initial value of fixed assets is distributed into the general term of their usage by depreciations.

– Maintenance. For buildings and constructions these expenses set 1% of balance value as a rule;

expenses of machines maintenance are taken into account as variable costs.

– Expenses of fixed capital usage

this indicator shows the level of economic efficiency of fixed assets usage

It is calculated as multiplication of average used capital and rate for calculation. In the example the size of average used capital is the 60 % of initial value of fixed assets.

These indicators are interpreted as marginal prices of product. So it means:

if the market price is more than threshold of production III, the production is advantageble in medium term period;

The investment into the industry will be advisable, if the additional (fixed) expenses of production is lower than difference between price of product and threshold of production III;

The production is unprofit, because the price of product is lower than Threshold of profitability;

8. Productivity and recoupment of used production factors

The recoupment of production factors presents itself their implementation during the goods production. The unit of estimation is unit of production process (DM/cattle-place, DM / unit) or production factor unit (DM / man-hour). The calculation of recoupment of production factor is made the next way:

Value of produced goods / cattle-place
– all expenses except for expenses of analyzing factor
= Recoupment of factor per 1 cattle-place
/ Quantity of used factor / cattle-place
= Recoupment of used factor unit

The achieved levels of productivity may be used as additional indices at estimation of economic efficiency of production process To estimate the productivity of production factor is necessary the volume of output (in natural sizes) subtract for the general amount of charged in production process production factors (in natural sizes too). As the summarizing of natural sizes of different production processes is not possible, so at the productivity estimation the only one factor will be taken into account. The calculated so productivity of used factors is called partial.

Work productivity = Productivity (in natural size) / 1 man-hour
Capital productivity = Productivity (in natural size) / (100) DM used capital

It is possible to subtract the value of output (monetary productivity) to quantity of used production factor

Work productivity = monetary productivity / 1 man-hour
Capital productivity = monetary productivity / (100) DM used capital

Recommended literature.

1. Agricultural systems – case studies: economics, technology and diversity / Oliver W. Castalonge [edit.], Nova science publisher, NY, 2008.
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THEME 10. PIGS FATTENING

1. General remarks
2. Value of output
3. Variable costs
4. Marginal income
5. Production factors requirement
6. Other aspects of marginal calculation
7. Threshold of production and profitability
8. Productivity and recoupment of used production factor

1. General remarks.

Inspite of production process of BHC maintenance, pig fattening does not depend on basic forage production and relatively on agricultural areas as a rule. The areas are needed for produced by industry manure utilization, but it is possible to sale the manure other enterprises. The unit of production process "Pigs Fattening" estimation is maintenance of 1 sow per year. This includes some farrows on a year, as a rule. The dividing of production processes of pigs fattening and pigs growing is in the point where there is the real market price for pig, achieved certain weight (25-30 kg). This price is the objective bases of pig value estimation.

It means that in pigs growing process all expenses of pig growing made before are attributed to sow. If the pig is not sold and grown further, so the expenses from this moment will be attributed to the process "Pigs fattening".

That's why, the relatively economic preferability of production processes of pigs growing and pigs fattening may be calculated more exactly. It allows to calculate marginal income more exactly. The maintenance of fattening pig heads is descripted at the marginal calculation of income. Pigs are kept at fricative floors with the type of feeding based on dry forage blend of own production.

The future long-term produced custom value is shown at plan calculation as a rule. It is determined based on the average values produced last few years. Recoupment of forage is calculated as ratio between annual usage of concentrate forage and annual general additional weight of cattle (additional weight of 1 pig multiplies on amount of rotation of pig heads on a year).

General additional weight is calculated as difference between the end weight of cattle and initial weight.

Average daily additional weight is calculated as ratio between general additional weight and fattening duration (days). It is necessary to add the requirement of work time for farm cleaning and cattle transfer to other production group to fattening duration. It allows to calculate the amount of head rotation per 1 cattle-place.

The reducing of these costs is possible by forming the exact plans of displacing and pigs realization and is required to increase the economic preferability of production process.

2. Value of output.

The value of produced products of "pigs fattening" production process depends on:

– average daily additional weight (accreation), and amount of fattening heads rotations also;

– forms of sale (classification of slaughter animals);

– quantity of organic fertilizers (for only own usage at methodic actual income calculation).

Market price of pork is determined by demand and proposition correlation mostly and so is significant various. The fluctuations of pork market prices are called "Pig cycles".

There are distinguished 2 forms of pork sale:

– sale of living weight;

– sale of slaughter weight.

The average price of head calculation is given in table 1. There are taken into account as relative class of prices so level of achieved animals weight also. The quality of pig depends on genetic factors mostly.

Value of output per 1 cattle place is calculated the next way:

*(Quantity of fattened animals per 1 cattle place – losses) **

*Average slaughter weight of animal * average price*

The value of organic fertilizers is estimated basing on the value of equivalent amount of processing substance (PS) of mineral fertilizers. While calculating the quantity of produced organic fertilizers it is supposed that one conditional head (500 kg of living weight) produces 18 m^3 of liquid manure with maintenance of dry substance 7,5 %. The maintenance of PS in manure of various animals and organic output per 1 conditional head of cattle is given in agricultural literature.

3. Variable costs.

Variable costs of pigs fattening includes on:

– expenses of young animals for repair purchasing;

– forage expenses;

– expenses of process mechanization;

– other variable costs (veterinarian, insemination, water, electricity, realization).

Work expenses are estimated only, if salary may be directly attributed to certain implemented production process. It means that work is attributed to this production process realization. The calculation of fixed work requirement in marginal calculation is not done and is given as fixed factor.

Expenses of young animals for herd repair purchasing depend on market prices of pigs. It is right independently of origin of purchase (own production or purchasing at the market). So it requires that price of pig sale in marginal calculation of pigs breeding will be the equal to the purchasing price of pig in production process of pigs fattening. It is possible to do additions to the price for purchased at the market pigs. The quantity of animals, fattened on a year per 1 cattle place attributes to the annual amount of animal rotations. The forage expenses factor has a significant influence on economic efficiency of pigs fattening. This influence depends on:

– level of forage usage;

– forage choice;

– forage price.

The level of forage usage is the most significant. It depends on:

– level of energy concentration and forage quality;

– genetic potential of animals;

– animals maintenance conditions.

Forage price is fluctuatible significantly. Determination of value of own production forage is the same that own production pigs value determination, e.g. is based on the market prices of identical forage. The control of sufficiency of nutritives in comparison with requirement of them may be determined basing on feed balance. The complete balance of nutritives requires taking into account additional components in ration also as energy and protein. Given in example data of nutritives content in forage are taken from special literature.

– variable costs of own mechanization arise from:

– crushing and shaking of forage (1- 3 DM per head);

– animals feeding (1.5 - 3.0 DM per head);

– ventilation and heating of stock-raising buildings (to 15 DM per head);

– implementation of organic fertilizers (4 - 6 DM per head), these sizes may be taken from special literature or enterprises data.

– Insemination

– Veterinarian, medicines; all payments for veterinarian, medicines, disinfection etc.

– Water, electricity. In practice the norm data is used from special literature

– Control, insurance

– Realization costs. Costs of transportation and transport insurance (if the custom doesn't pay their as the additions for pig value) expenses of slaughter sows sale.

4. Marginal income.

The marginal income is calculated as difference between commodity goods value and variable direct costs of their production. There is the necessity to calculate the marginal income per 1 cattle-place for estimation of economic efficiency of production process. This indicator calculated per 1 head has the least significance, because does not take into account the annual animals rotation. Marginal income per 1 man-hour can be used as the scale of work productivity in comparison with other production processes (for example, birds fattening).

5. Production factors requirement.

There is the necessity to take into account that duration of production process is less than 1 year. The capital received from animals of first rotation sale can be used for further rotation financing. The duration of living and circulating capital usage approximately is equal to 1 rotation of animals duration. formula of approximate calculation of living and circulating capital requirement is given below:

$$RLCC = \frac{PP + 0.5FP + VC}{2} * \frac{FD}{365},$$

where RLCC – requirement of living and circulating capital;

PP – pig price;

FP – forage price;

VC – variable costs, all;

FD – fattening duration, days

The requirement of work time per 1 sow depends on the basic herd size, system of maintenance and level of animal productivity. In practice the normative data are used as a rule.

6. Other aspects of marginal calculation

The next proportional- variable direct costs are calculated too:

– expenses of using living and circulating capital;

– work expenses;

– alternative expenses (buildings, areas etc).

To determine the objective marginal income the value of output must be reduced on the proportional variable direct costs.

7. Threshold of production and profitability.

The calculation of threshold of production and threshold of profitability presupposes the net calculation of expenses per 1 unit, for example, per 1 sign of products.

The pig fattening process is related with production of basic (1 kg of pork accreation) and side products (slaughter sows, organic fertilizers) So the calculation of variable costs of basic goods production requires to subtract of side products income from sum of variable costs. The side products are slaughtered cattle and manure. The value of side products is subtracted from general sum of variable costs. The threshold of production presents itself general variable costs per unit of products (DM / kg of meat). The next expenses are considered in calculation:

- variable costsaccounted in marginal income calculation

– subtracting the value of organic fertilizers (side products);

– subtracting the value of slaughter sow;

- other variable costs not accounted in marginal income calculation;

– expenses of living and circulating capital usage;

– salary rate for unpaid work (the alternative usage of work is possible for 15 DM/hour);

– salary of work;

– other alternative expenses (fixed assets usage);

– depending on time: expenses of planned investments.

The threshold of profitability presents itself the sum of expenses per unit of basic goods. This indicator allows to determine the long-term minimal level of price

(cover of general sum of expenses) There are the next items of expenses used in calculation:

– variable costs, shown in marginal calculation;

– except for organic fertilizers value (side products) and value of

– slaughter animal meat (old sow);

– all other variable costs, not accounted in marginal calculation (for example, expenses of work force and circulating capital usage etc);

– expenses of fixed assets exploitation (fixed costs); If the alternative usage of fixed assets is possible so there will be the next ways to determine expenses: – Fixed costs of alternative costs (As a rule!) The fixed expenses such as depreciations, maintenance, capital usage expenses are taken into account. – Fixed costs of alternative costs (As a rule!) The alternative expenses are taken into account. The one time taking into account the alternative and fixed expenses of fixed costs is wrong.

– other fixed and indirect expenses.

Fixed expenses of buildings, constructions and technique usage include:

– Depreciations (capital usage). The initial value of fixed assets is distributed into the general term of their usage by depreciations.

– Maintenance. For buildings and constructions these expenses set 1% of balance value as a rule; expenses of machines maintenance are teken into account as variable costs.

– Expenses of fixed capital usage. this indicator shows the level of economic efficiency of fixed assets usage. It is calculated as multiplication of average used capital and rate for calculation. In the example the size these indicators are interpreted as marginal prices of product. So it means:

- if the market price is more than threshold of production III, the production is advantageble in medium term period;
- the investment into the industry will be advisable, if the additional (fixed) expenses of production is lower than difference between price of product and threshold of production III;
- the production is profitable, because the price of product is higher than threshold of profitability;

8. Productivity and recoupment of used production factors

The recoupment of production factors presents itself their implementation during the goods production. The unit of estimation is unit of production process (DM/cattle-place, DM / unit) or production factor unit (DM / man-hour). The calculation of recoupment of production factor is made the next way:

Value of produced goods / cattle-place
– all expenses except for expenses of analyzing factor
= Recoupment of factor per 1 cattle-place
/ Quantity of used factor / cattle-place
= Recoupment of used factor unit

The achieved levels of productivity may be used as additional indices at estimation of economic efficiency of production process

To estimate the productivity of production factor is necessary the volume of output (in natural sizes) subtract for the general amount of charged in production process production factors (in natural sizes too). As the summarizing of natural sizes of different production processes is not possible, so at the productivity estimation the only one factor will be taken into account. The calculated so productivity of used factors is called partial.

Work productivity = Productivity (in natural size) / 1 man-hour
Capital productivity = Productivity (in natural size) / (100) DM used capital

It is possible to subtract the value of output (monetary productivity) to quantity of used production factor

Work productivity = monetary productivity / 1 man-hour
Capital productivity = monetary productivity / (100) DM used capital

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GLOSSARY

Agricultural area – Any area taken up by arable land, permanent grassland or permanent crops.

Arable Crops – In the context of the common agricultural policy, arable crops consist of the following: cereals (such as wheat, barley, oats, rye, maize, and sorghum), oilseeds (soya beans, rape seed and sunflower seed), protein crops (peas, beans and lupins), flax and hemp.

Asset - A possession of value, usually measured in terms of money.

Capital – The physical equipment (buildings, equipment, human skills) used in the production of goods and services. Also used to refer to corporate equity, debt securities, and cash.

Capital good: A good that is a manufactured (or previously produced) factor of production that is used to manufacture or produce other things. Common examples of capital goods re the factories, buildings, trucks, tools, machinery, and equipment used by businesses in their productive pursuits. The acquisition of capital goods is the primary goal of business investment.

Cost: Best referred to as opportunity cost, this is the highest valued alternative foregone in the pursuit of an activity. This is a hallmark of anything dealing with economics -- or life for that matter -- because any action that you take prevents you from doing something else. The value expressed in terms of satisfaction of the foregone activity is your opportunity cost. Because there are usually several alternatives that aren't pursued, opportunity cost is the highest-valued one. An opportunity cost is sometimes compensated with some form of payment, like a wage. However, the existence of an opportunity cost is independent of any actual cash outlay.

Demand – The total quantity of goods and services consumers are willing and able to buy at all possible prices during some time period.

Depreciation: A more or less permanent decrease in value or price. "More or less permanent" doesn't include temporary, short-term drops in price that are common in many markets. It's only those price declines that reflect a reduction in consumer satisfaction. While all sorts of stuff can depreciate in value, some of the more common ones are capital, real estate, corporate stock, and money. The depreciation of capital results from the rigors of production and affects our economy's ability to produce stuff. A sizable portion of our annual investment is thus needed to replace depreciated capital. The depreciation of a nation's money is seen as an increase in the exchange rate. This process is described in detail in the entry on the J curve.

Direct: The mathematical notion that two variables change in the same direction, that is, an increase in X goes with an increase in Y, or a decrease in X goes with a decrease in Y. The alternative to a direct relation is an inverse relation, in which an increase in one variable goes with a decrease in the other. Direct relations are graphically illustrated by positively-sloped curves, a common example being the supply curve.

European Union (EU) – A group of twenty-seven democratic European countries - its member states - committed to working together for peace and prosperity. The member states have set up common institutions to which they have entrusted some of their sovereignty. This allows the member states to consider matters of joint interest and to make decisions in a democratic matter at the European level. These decisions are then laid down as binding and enforceable law.

Factors of production: The four basic factors used to produce goods and services in the economy--labor, capital, land, and entrepreneurship. These are also called resources or scarce resources. The term "factors of production" is quite descriptive of the function these "resources" perform. Labor, capital, land, and entrepreneurship are the four "factors" or items use in the "production" of goods and services. So there you have it "factors" of "production."

Fixed cost: In general, cost that does not change with changes in the quantity of output produced. More specifically, fixed cost is combined with the adjectives "total" and "average" to indicate the overall level of fixed cost or the per unit fixed cost. Fixed cost is incurred whether of not any output is produced. The same fixed cost is incurred at any and all output levels. This means that total fixed cost is, in fact, FIXED. However, it also means that average fixed cost, or fixed cost per unit, declines as the output level increases. Spreading out $100 over 1,000 units gives a lower per unit fixed cost that spreading out $100 over 10 units.

Fixed factor of production: An input whose quantity cannot be changed in the time period under consideration. This usually goes by the shorter term fixed input and should be immediately compared and contrasted with variable factor of production, which goes by the shorter term variable input. The most common example of a fixed factor of production is capital. A fixed factor of production provides the "capacity" constraint for the short-run production of a firm. As larger quantities of a variable factor of production, like labor, are added to a fixed factor of production like capital, the variable input becomes less productive. This is, by the way, the law of diminishing marginal returns. For more detailed discussion, take a look at the shorter, more commonly used alias of fixed factor of production, which is fixed input.

Goods: When used without an adjective modifier (like "final" goods or "intermediate" goods), this generically means physical, tangible products used to

satisfy people's wants and needs. This term good should be contrasted with the term services, which captures the intangible satisfaction of wants and needs. As such, you will frequently see the plural combination of these two phrases together "goods and services" to indicate the wide assortment of economic goods produced using the economy's scarce resources. As you might imagine this general notion of wants and needs satisfying goods and services pops up throughout the study of economics.

Income: Revenue earned or received by households that can be used for consumption or saving. For the aggregate economy, earned income is termed national income, while received income is termed personal income. The key is that income for the aggregate economy is generated in the production of goods and services.

Indirect: The mathematical notion that two variables change in the opposite directions, that is, an increase in X goes with a decrease in Y, or a decrease in X goes with an increase in Y. The alternative to an indirect relation is a direct relation, in which an increase in one variable goes with an increase in the other. Indirect relations are graphically illustrated by negatively-sloped curves, a common example being the demand curve.

Input: The resources or factors of production used in the production of a firm's output. This term is most frequently associated with the analysis of short-run production, and is often modified by the terms fixed and variable, as in fixed input and variable input. In the short run, the quantity of a fixed input cannot be changed, meaning it cannot be used to expand output. In contrast, a variable input can be changed, making it THE means of expanding output in the short run.

Investment – The purchase of a security, such as a stock or bond.

Labor force: The total number of people willing and able to exert mental and/or physical efforts in productive activities. In principle, this is everyone 16 years of age and over who is willing and able to work. In practice, it includes the sum of anyone over 16 years who is employed or unemployed but actively seeking a job. The labor force is essentially a more technical term for the economy's labor supply.

Land: One of four basic categories of resources, or factors of production (the other three are labor, capital, and entrepreneurship). This category includes the natural resources used to produce goods and services, including the land itself; the minerals and nutrients in the ground; the water, wildlife, and vegetation on the surface; and the air above.

Limited resources: Finite quantities of labor, capital, land, and entrepreneurship available to an economy for the production of goods and services. This is one half of the fundamental problem of scarcity that has plagued humanity since the beginning of time. The other half of the scarcity problem is unlimited wants and needs.

Loan: In general, a transaction in which a legal claim is exchanged for money. The legal claim is typically a contract or promissory note stipulating when and how the money will be repaid. The lender gives up the money and receives the legal claim. The borrower gives up the legal claim and receives the money. A loan can be either an asset or a liability, depending on who does the borrowing and who does the lending. To the borrower, a loan is a liability, something that is owed. The borrower must pay off the loan or repurchase the legal claim. However, to the lender, a loan is an asset, something that is owned. In fact, loans represent a significant part of a bank's assets.

Manure – Animal droppings (faces) mixed with straw or similar material used as bedding in sheds, barns or night yards. Animal manures are an excellent source of plant nutrients. Approximately 70-80% of the nitrogen, 60-85% of the phosphorus and 80-90% of the potassium in feeds is excreted in the manure. If heaped to rot well before use, farmyard manure does not cause crop burn, increases most crop yields and water-retaining properties of soils.

Marginal analysis: A basic technique used in the economics that analyzes small, incremental changes in key variables. The economic obsession with marginal changes exists for at least two reasons. One reason is that many economic decisions made in the real world are made "at the margin." A second reason for using marginal analysis can best be termed analytical sophistication.

Marginal cost and marginal product: Because variable cost is largely associated with the cost of employing a variable input in the short run, it's possible to identify a connection between the marginal cost curve and the marginal product curve. In particular, the quantity of output in which marginal cost is at a minimum, is the same quantity of output produced by the variable input when the marginal product of the variable input is at a maximum. In addition, over the range of production in which the variable input experiences increasing marginal returns and marginal product increases, the marginal cost curve declines. And over the range of production in which the variable input experiences decreasing marginal returns brought on by the law of diminishing marginal returns and marginal product increases, the marginal cost curve is rising.

Marginal cost: The change in total cost (or total variable cost) resulting from a change in the quantity of output produced by a firm in the short run. Marginal cost indicates how much total cost changes for a give change in the quantity of output. Because changes in total cost are matched by changes in total variable cost in the short run (remember total fixed cost is fixed), marginal cost is the change in either total cost or total variable cost. Marginal cost, usually abbreviated MC, is found by dividing the change in total cost (or total variable cost) by the change in output.

Market: The organized exchange of commodities (goods, services, or resources) between buyers and sellers within a specific geographic area and during a given period of time. Markets are the exchange between buyers who want a good --the demand-side of the market--and the sellers who have it--the supply--side of the market. In essence, a buyer gives up money and gets a good, while a seller gives up a good and gets money. From a marketing context, in order to be a market the following conditions must exist. The target consumers must have the ability to purchase the goods or services. They must have a need or desire to purchase. The target group must be willing to exchange something of value for the product. Finally, they must have the authority to make the purchase. If all these variables are present, a market exits.

Materials: The stuff used in the production of tangible products that become the tangible products. Materials, also termed raw materials, are part of the land category of scarce resources. Space is also part of the land resource category. Another term that works as a synonym for materials is natural resources. Perhaps it's obvious that without materials, there would be no tangible products.

Monetary: Relating to money, usually used as a modifier with other terms, generating such concepts as monetary policy, monetary unit, and monetary authority.

Needs: This are often thought of as a physiological or biological requirement for maintaining life, such as the need for air, water, food, shelter, and sleep. Satisfaction is achieved by fulfilling needs. Physiological needs should be contrasted with psychological wants that make life more enjoyable but are not necessary to stay alive. However, when push comes to shove, and the nitty gets down to the gritty, it matters very little to markets if people need goods or want goods, so long as they are motivated to satisfy them. This motivation is what drives economic activity.

Net income: A common term for profit, as the difference between total revenue and total cost. When used in the real world of business wheeling and dealing, this notion of net income general refers to accounting profit rather than economic profit. The "net" aspect of net income indicates that some (that something being cost) is deducted from total or "gross" income. Other common terms used in this same context are net revenue and net earnings.

Output: A generic term for a tangible good or an intangible service that is the end result of the production/resource transformation process. This notion of output, which also goes by the alias product, usually surfaces in the context of analyzing the short-run production of a firm. The short-run relation between a variable input and output is of particular interest because it reveals the law of diminishing marginal returns. This law indicates that additional quantities of a variable input, when added to a fixed input, have decreasing marginal products, or marginal returns.

Production cost: The opportunity cost of using labor, capital, land, and entrepreneurship in the production of goods and services. Production cost is important to supply. The price received by a seller must be great enough to cover production cost. Note that production cost includes what you probably think of as the traditional "cost of doing business," but it includes other less obvious costs, as well. While labor, capital, and land typically involve an explicit cost--an actual money payment--the cost of entrepreneurship is often an implicit cost. In particular, the cost of entrepreneurship is termed normal profit.

Production inputs: The resources, or factors of production, used in the production of output by a firm. This term is most frequently associated with the analysis of short-run production, and is often modified by the terms fixed and variable, as in fixed input and variable input. The quantity of a variable input can be changed in the short run and the quantity of a fixed input cannot be changed.

Production: The process of transforming the natural resources of the land into consumer satisfying consumption and capital goods using scarce resources. In a world of scarcity, with unlimited wants and needs and limited resources, living standards are enhanced by transforming the planet's raw materials, that don't provide much satisfaction in their natural state, into goods, that provide more satisfaction.

Productivity: The ratio of output (goods and services) produced per unit of input (productive resources) over some period of time.

Profit: As a generic term, this is the difference between revenue and cost. There are, however, three specific sorts of profit, each with a different meaning. Accounting profit is the difference between revenue and accounting expenses. Economic profit is the difference between revenue and the opportunity cost of production. Normal profit is the economic profit that could be earned by an entrepreneur in another business and is thus an opportunity cost deducted from revenue when calculating economic profit.

Quantity: In a market, the amount of a good that is bought, sold, or traded among buyers and sellers. In a standard market diagram, quantity is displayed on the horizontal axis.

Quota - An imposed limit on the quantity of goods produced or purchased. Import quota can be used to restrict the purchases of goods from foreign origins.

Raw materials: The stuff used in the production of tangible products that become the tangible products. Raw materials, also shorted to just materials, are part of the land category of scarce resources. Space is also part of the land resource category. Another term that works as a synonym for materials is natural resources. Perhaps it's obvious that without materials, there would be no tangible products.

Requirement: This is often thought of as a physiological or biological need for maintaining life, such as the need for air, water, food, shelter, and sleep. Satisfaction is achieved by fulfilling needs. Physiological needs should be contrasted with psychological wants that make life more enjoyable but are not necessary to stay alive. However, when push comes to shove, and the nitty gets down to the gritty, it matters very little to markets if people need goods or want goods, so long as they are motivated to satisfy them. This motivation is what drives economic activity.

Resources: The labor, capital, land, and entrepreneurship used by society to produce consumer satisfying goods and services. Land provides the basic raw materials--vegetation, animals, minerals, fossil fuels--that are inputs into the production of goods (natural resources). Labor is the resource that does the "hands on" work of transforming raw materials into goods. Capital is the comprehensive term for the vast array of tools, equipment, buildings, and vehicles used in production. Entrepreneurship is the resource that undertakes the risk of bringing the other resources together and initiating the production process.

Semi-finished (Intermediate) goods and services: Goods and services that are used as inputs or components in the production of other goods. Intermediate goods are combined into the production of finished products, or what are termed final goods. Intermediate goods will be further processed before sold as final goods. Because gross domestic product seeks to measure the market value of final goods, and because the value of intermediate goods are included in the value of final goods, market transactions that capture the value of intermediate goods are not included separately in gross domestic product. To do so would create the problem of double counting.

Services: Activities that provide direct satisfaction of wants and needs without the production of tangible products or goods. Examples include information, entertainment, and education. This term service should be contrasted with the term good, which involves the satisfaction of wants and needs with tangible items. You're likely to see the plural combination of these two into a single phrase, "goods and services," to indicate the wide assortment of economic production from the economy's scarce resources. Economic activities -- such as transportation, banking, insurance, tourism, telecommunications, advertising, entertainment, data processing, and consulting -- that normally are consumed as they are produced, as contrasted with economic goods, which are more tangible.

Side (By-) product: One of two goods that are produced jointly using the same resource--that is, the production of one good automatically triggers the production of the other. Also termed joint products or complements-in-production, the phrase by-product is often used when one of the products is unwanted or of secondary

importance. For example, sawdust is generally considered a by-product from producing lumber from trees.

Supply: A schedule of how much producers are willing and able to sell at all possible prices during some time period.

Tax: Any sort of forced or coerced payment to government. The primary reason government collects taxes is to get the revenue needed to finance public goods and pay administrative expenses. However, the more astute leaders of the first estate have recognized over the years that taxes have other effects, including--(1) redirecting resources from one good to another and (2) altering the total amount of production in the economy. As such, taxes have been used to correct market failures, equalize the income distribution, achieve efficiency, stabilize business cycles, and promote economic growth.

Total cost: The opportunity cost incurred by all of the factors of production used by a firm to produce of a good or service, including wages paid to labor, rent paid for the land, interest paid to capital owners, and a normal profit paid to entrepreneurs. Total cost is most important in the analysis a firm's short-run production decision and is frequently separated into total variable cost and total fixed. cost.

Value: Quite simply, this is the amount of consumer satisfaction directly or indirectly obtained from a good. service, or resource. The more a good satisfies a person's want or need, then the more valuable it is to that person. Furthermore, different people are likely to place different values on a good. Resources are valuable to the degree that they are used to produce stuff that consumers want. The bottom line is that value, like beauty, is truly in the eye of the beholder.

Value-added tax: A tax on the extra value added during each stage in the production of a good. Most of the stuff our economy produces goes through several "stages," usually with different businesses. In each stage, resources do their thing to the good to make it a little more valuable. For example, an ice cream store can take 50 cents worth of ice cream, fudge, and whipped topping and turn it into a hot fudge sundae that's valued at $1.50. The efforts of the ice cream resources thus add $1 in value. A value-added tax is based on this extra value. While it's been debated off and on in the United States, a value-added tax is commonly used in Europe.

Variable cost: In general, cost that changes with changes in the quantity of output produced. More specifically, variable cost is combined with the adjectives "total" and "average" to indicate the overall level of variable cost or the per unit variable cost. Variable cost depends on the amount of produced. If there is no production, then there is no variable cost.

Weight: When applied to location theory, the relative attractive force of one activity to another based on transportation cost. The weight of an activity in this context is comparable to the weight of matter subject to gravitation forces. The weight of an activity is greater if it incurs higher transportation cost. As such, it is attracted, or pulled, to other activities to reduce transportation cost. With the weight (transportation cost) of an activity is often related to physical weight (heavier items cost more to move), it need not be. Other factors affecting weight include special handling (security, comfort) and type of transportation (walking, automobile, airplane).

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ECONOMICS OF PRODUCTION

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