

Up-to-date technologies in plant growing in historical foreshortening and view of euro integration calls

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The purpose. To study state of models of technologies in plant growing and prospects of their development. **Methods.** Analysis, synthesis, historical search, generalization. **Results.** It is established that in Ukraine in conditions of intensification of production of plant growing the most perspective are the following three models: intense, organic (biological) and *no-till*. In the most widespread intense technologies the greater influence on productivity cause grades, fertilizers and means of protection of plants. Biological technologies provide reception of organic production. *No-till* technology has also significant advantages: expediency of use in conditions of deficiency of moisture and on slope lands, decrease of expenses, obligatory use of plant residues for mulching surface of soil. **Conclusions.** Analysis of development of models of technologies in plant growing shows that in bridge will be improved high-intensity (waste), biological, *no-till*, *strip-till*, and *crop-miks* technologies. That will provide the highest economic and ecological indexes.

Key words: *plant growing, models of technologies, prospects.*

Introduction. The main element of world agriculture is branch of plant growing. Mankind uses 93% of food products produced from plant products. If account the needs of livestock feed, the value of plant cultivation grows even higher.

With grains and oilseed crops in the world produce more food 2/3. They are and will be growing demand, so the structure of sown areas dominate these crops [1]. It is very important which way to develop agricultural production in the twentieth century, what technologies will be applied in Ukraine: intensive, resource saving, biological, technologies of minimum and zero tillage of land etc.[2]. But model technology affects the environment and efficiency of production, and state of soil favours fertility increase, or vice versa, causing their degradation and so on. That's why, the model of technology always determine the direction of research, the need of experimental grounds of individual technology elements, their relevance and competitiveness in comparison with other technologies coming to market in Ukraine [3].

In the last 20 years in the world agronomic science, essential changes in plant production technologies are taken place. Which of technological development can be transferred to the fields of Ukraine, and which can create complex problems for agricultural production in the future? These questions must be answered today by Agrarian Sciences of Ukraine. It is important to assess the current state when selecting prospects properly and especially the previous achievements towards developing models of technology in the leading agricultural countries, to assess and model their potential strategies for Ukraine in the future.

Analysis of recent researches. As the eminent historian Yuri Kanyhin [4] mentions that already in VIBC high level development of land farming was on the lands of Aratta (Prypontyda), i.e. the territory of modern Ukraine. Here, arias (from AR (Sanskrit) – earth, soil) initiated the first grain growing civilization. In those days the Egyptians purchased wheat in our ancestors. Since Ukrainian farming technologies spread throughout the world but Ukraine became agricultural state for ever.

Actually from Ukraine most grains and grain-legume crops such as wheat, rye, barley, oats, peas, lupine, food beans and others are originated. Currently, genetically Ukrainian, since Tripili civilization, grain crops are used by humanity, introduced in different parts of the world. Ukrainian nation gave bread for the world.

The evolution of technology development of plant cultivation is connected with the scientific progress. For the last years the development of technologies has gone the way from comprehensive mechanization to chemicalization (60-80 years.) – up to intensification and highly intensive (exact) technologies (2000-2010 yy.) on the basis of information systems [5,6]. Today, the modern technologies No-till [7], Strip – till [8], Crop-miks [9,10] are directed to ecologyzation and application of achievements of biotechnology, microbiology and nanotechnologies.

The purpose of researches. Comparative evolution of technologies development in plant growing and land farming. The grounds of development strategies in Ukraine in the future.

Methods of researches. The historical search of technologies formation. Analysis of changes and problems in modern technologies. Estimate of models technologies in plant cultivation.

The results of research. Excursus in the recent past shows that in the XX century certain stages of improvement technologies of crops can be distinguished and according to select the most used names of model technologies. In 30-50 years, the basis of progress remains the problems of mechanization of production processes. In the technology of grain crops growing, manual labor, especially during harvesting was replaced completely. Industrial technologies for growing were created for many crops. Especially, this term was popular in flax cultivation, potatoe cultivation and vegetable cultivation. It should be noted that negative phenomenon of this stage was excessive thickening of heavy aggregates.

A characteristic feature of the 60's. became widespread application of fertilizers. This permits to increase agricultural output. Due fertilizers application the yield capacity increased by 30-60%. Balance of nutrients in the soil was sustained with a help of commercially-represented agrochemicals. There were prerequisites for the creation of progressive technologies. Actually the name probably is not quite accurate, because any new technology should be progressive, this term is widely used in the books and textbooks.

Since the 70s, pesticides are applied with fertilizers. Now you can protect the main crops from weeds, pests, diseases and lodging using plant protection means. This provided a significant increase of yield capacity. In the early 80's the following technologies began to call them intensive. They are the most high-yielding, common in the European Union. To increase the yield capacity of grain crops from 40 kg/ha to 60-70 kg/ha (Germany, France, England etc.). was possible only after the introduction of intensive technologies. A striking example of them was intensive technology of winter wheat cultivation, which was based on knowledge of crop biology, making it possible to ensure maximum plant needs at all stages of organogenesis. According to the Institute of NAAS fodder, intensification of soybean growing technology made it possible to increase profitability in 1,7-1,8 times (Table 1).

1. Comparative evaluation of the competitiveness of soybean technology (Institute of feed and agriculture skirts NAAS).

Indices	Adaptive	Intensive	High intensity
Yield, t/ha	2,2	3,0	3,5
Contents of Crude Protein,%	36,2	38,1	38,4
Cost of harvest, uah/ha	7700	10500	12250
Production costs, uah/ha	3274	3766	4520
Cost of 1 ton, uah	1488	1255	1291
Net income, uah/ha	4426	6734	7730
Level of profitability, %	135	179	171

Intensive Technologies – the main instrument providing mankind with food and maintaining food security worldwide.

Production relatively of cheap fertilizers and pesticides has led to drastic changes in traditional technologies. Crop rotations were broken, organic fertilizers were rejected. Intensive technologies created the problem of environmental pollution and residues of agrochemicals. That increase of yield capacity by improving technology in the second half of the XX century led to the emergence of environmental problems.

That's why in 90 years models of resource-saving technologies were created. A characteristic feature of resource saving technology is rotation realization with the obligatory introduction in crop rotation of field-legumes. This allows reduction of 30-50% application of fertilizers rates and to some extent the volumes of application of plant protection means. The level of crops yield capacity by these technologies almost not reduced compared with intensive ones. They are distributed in Germany, Denmark, Austria, Switzerland, Sweden and others.

Despite significant progress in increasing yield capacity, intensive technology has created no less impressive energy balance problems. Not in all cases confirmed as economic efficiency, especially given significant subsidies in agricultural production in most countries. All this led to the search of biological (organic) technologies. The main features of biological technologies are the effective use fruitchangeable principle in crop rotations, fertilization system on the bases of organic matter, plant residues, green manure, straw etc., complete rejection of application of agrochemicals. Expansion of perennial legumes sowings (clover, alfalfa, etc.) is a prerequisite for biological systems of farming. Biological technologies in plant cultivation achieve a balanced combination of natural, biological, technological, organizational, economic, information spheres of human activity. They provide a receipt of environmentally net products, and they have created agrophytocenoses which become agrarian landscapes that promote the regeneration of air and water, regulate carbon and oxygen circulation, ensure environmental cleanliness of nature, support safety and health. However, we know that the main drawback of biological technology is the low productivity – such as the transition to the biological production of grain production in the world declined at least twice, which causes worsening of food security in the world.

Biological technologies are spread in Europe, especially in Austria, Switzerland, Sweden, Germany and others. In Ukraine, there are very favorable conditions for widespread biological technologies. This, above all, high natural fertility of the soil, which can solve the problem of batteries. The essence of biological technologies do not simplify the contrary but the penetration depth into the nature of forming and functioning agrophytocenoses based on modern advances in biochemistry, physiology, microbiology, ecology, biotechnology, genetics and other fundamental sciences.

The most popular, over the past decade in the world have become technologies of zero tillage (NO-till). They were made possible through the use of large amounts of plant protection products. They provide high level of productivity, but much inferior to intensive technologies.

In modern agriculture, there is terminology chaos as to the names of technologies, which are more than 20 versions. There are some different technologies: intensive, resource saving, biological and zero.

Thus, the most profitable for Ukraine farmer are intensive and zero technologies. However, in Ukraine, as in any other country, there are favorable conditions for the development and distribution of biological technologies, which are not allowed to use agrochemistry. This is particularly high natural fertility of the soil.

2. Technology Models

Where are wide-spread	Name	The level of productivity	Environmentally harmful
Europe, EU	Intensive	Very high	Environmentally
Europe, Austria, Switzerland, Sweden, Ukraine	Resource saving	High	Environmentally safe
Europe,, Ukraine	Biological	Average	Environmentally clean
USA, Argentina, Brazil, Canada, China	zero (direct sowing) No - till	High	Environmentally safe
US, Ukraine	Strip - till	High	Environmentally safe

The reason for the spread of biological plant cultivation and production of environmentally pure products have lower rates of agrochemicals application in the past 50 years in Ukraine, compared with the Western Europe. Thus, in the 60's - 49 kg/ha of active ingredients of fertilizers were introduced, but at the end of the 80's- 177 kg/ha and in the 90's – 21kg/ha.

In Western Europe in those years 300-350 kg/ha were applied, together with them fluorine, chlorine, heavy metals were applied in the soil.

Therefore, in Ukraine the intensive technologies will be improved, providing the highest yield capacity ; zero and biological technologies will be perspective ones directing for preservation of environment , quality and safety of plant production.

Revolutionary technological changes in plant cultivation.

In agrarian production of Ukraine the transition to the crop cultivation in short rotation period was completed. For example, two-field : corn – soybeans; three-field: soybean – winter wheat – corn; soybean – winter wheat – sugar beet; four-field: soybean – winter wheat – corn – barley; rape – winter wheat – soybean – barley and so on. According to this principle, the integrated farming systems work. So , for example, the requirement to return sunflowers in 7-8 years on previous field in the rotation, you need to watch it, especially where there no sunflower broomrape.

Thus, the current state of agricultural markets doesn't favour crop rotation preservation ; in agriculture of steppe and forest zone of Ukraine, cereals and oilseed crops are grown mainly. A common thesis "Healthy Economy of agriculture – a sick rotation" reflects the strategy of intensification of plant cultivation in the XXI century. Paradoxically sound, but may return to the rotation forced Technology No-till, as monocultural cultivation for this technology – a direct path to bankruptcy.

Go to the minimum-tillage and then go to (technology No-till), was made possible, thanks to the widespread application of herbicides of continuous action.

There is a systematic technical re-equipping of upgrading technologies in plant cultivation. Multifunction devices (units) are created that allow to perform various operations in one pass. Thus, using tillage – sowing unit, soil is cultivated efficiently and simultaneously, the sowing of cereals, legumes, rape and other crops are performed. The number of technique passes on the field are reduced and favorable conditions for soil biota development, accumulation and water use, macro and micronutrients are created; different philosophy of soil usage is formed as a means of production, as a living substance; with the application of fertilizers, phytohormones, water-soluble compounds etc. This is a huge reservoir for scientific research of agricultural science which need to be answered, or capable of No-till technology in the conditions of climate changes to ensure the expanded reproduction of soil fertility and sustainable production of quality and safe crop production.

Now the agriholdings have used very sophisticated techniques: rotary plows, combined implements for preparing the soil for sowing, soil-tillage sowing units, self-propelled sprayers, combine harvesters, combine harvesters for sugarbeets, potatoes and so on. These units are equipped with navigation systems of GPS, allowing you to use the technique more effectively.

In modern agricultural production, new high-yield varieties and hybrids are introduced, that provide the full realization of intensive and precise technologies. In Ukraine there are world leaders of seed production: Pioneer, Monsanto, BASF, Syngenta, CVS, Limagrain, EuralisSemens and others. Seeds efficiently prepared, calibrated for most crops are treated by insecticides and fungicides of extremely high quality. As a result, it became possible to reduce seed rates, e.g. rape – up to 2.5-3.0 kg/ha (30-60 seeds/m²), sugarbeet – up to 1.0-1.3 of seeding units, that differs from standard rates in the recent past. The proposed intensive and precise technologies provide to change our attitude to the yield formation, in particular needs revision and definition grain crops rates. The winter wheat seeds are sown 2.0-2.5 mln.seeds/ha in the leading agricultural countries (France, Germany, Poland), but in Ukraine 5-6 mln.seeds of winter wheat are sown up to our days. It should be noted that high rates of grain sowing of 5-6 mln. Seeds/ha are usually advisable to use only in case of unsatisfactory quality seeds, poor preparation of soil for sowing and late sowing.

In the last two or three years of intensive cultivation technologies have begun to use not only traditional batteries – nitrogen (N), phosphorus (P), potassium (K), but also sulfur (S), magnesium (M), calcium (Ca) and trace elements on chelate base (iron (Fe), boron (B), manganese (Mn), zinc (Zn), copper (Cu), molibden (Mo), cobalt (Co). The composition of some micronutrients also includes silicon (Si), iodine (I) and titanium (Ti). The leaf application of fertilizers provides high efficiency. In many agricultural enterprises of Ukraine, fertilization standards meet European standards. The cost of mineral fertilizers in the cost of such technologies achieves 40-45% and sometimes 50%. The yield is determined not so much by crop rotation as by the fertilizers application and plant protection products (Fig.1).

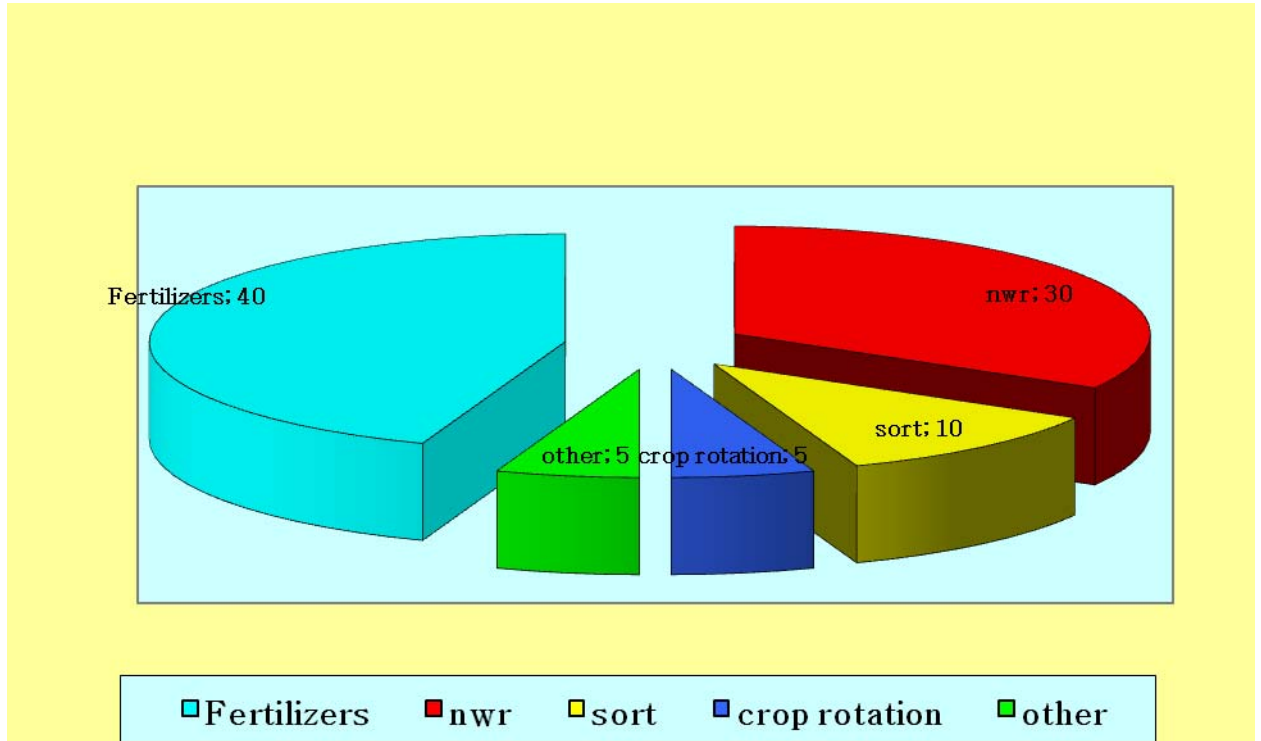


Fig. 1. Share intensification factors on the yield of grain crops

The main feature of modern intensive technologies are widely used crops protection products for controlling weeds, pests, diseases, protection of lodging. This was the basic foundation of revolutionary

changes in plant cultivation technologies. The state of agrophytocenoses is controlled from germination to maturation, provided by optimal conditions for the growth and formation of high-quality yield capacity.

It naturally raises the question- are the changes in plant cultivation positive or negative? Definitely positive, as they allow to increase the yield and provide ever increasing world population by foodstuffs. To ask questions in that way is incorrectly, because it's inevitable natural changes caused by technological progress and society development.

Conclusions

Technologies of plant cultivation in Ukraine for the last years sustained revolutionary changes due to introduction of perfect agricultural technique, usage of different tillage versions, increase efficiency of fertilization system and optimization of plant protection means. The analyses of models development shows that intensive, biological and technologies No-till, Strip-till, Crop-miks will be improved in parallels, providing the best economic indices.

The prospect of plant cultivation development in Ukraine can be expansion of sown areas of niche crops, introduction of new varieties and hybrids, widely introduction of associative nitrogen fixation but not legumes, intensification of photosynthesis process.

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