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CONSERVATION TILLAGE AS AN ALTERNATIVE TO TRADITIONAL PLOWING IN MODERN AGRICULTURE

У статті розглянуто безвідвальний обробіток ґрунту як ефективну альтернативу традиційній оранці в умовах сучасного землеробства. Проаналізовано основні переваги цієї технології, зокрема збереження структури ґрунту, підвищення рівня вологи, зменшення ерозійних процесів та раціональне використання енергетичних ресурсів. Висвітлено роль сучасної сільськогосподарської техніки у впровадженні ґрунтозберігаючих технологій.
Ключові слова: *безвідвальний обробіток ґрунту, традиційна оранка, ерозія ґрунту, збереження вологи, родючість ґрунту, ресурсозбереження, сучасна агротехніка.*

The article considers non-moldboard tillage as an effective alternative to traditional plowing in modern agriculture. The main advantages of this technology are analyzed, including preservation of soil structure, moisture retention, reduction of erosion processes, and rational use of energy resources. Particular attention is paid to the role of modern agricultural machinery in the implementation of soil-conserving technologies.
Keywords: *non-moldboard tillage, traditional plowing, soil erosion, moisture conservation, soil fertility, resource saving, modern agricultural machinery.*

Due to the deterioration of the ecological condition of agriculture, studies and tests of new soil-protective technologies were conducted in many countries as early as the 20th century. Their basis consisted of minimizing the number and depth of soil tillage operations, regulating the runoff of rain and meltwater, and leaving part of the stubble on the field surface in order to increase the soil's resistance to erosion. However, studies have shown that not all new technologies can completely solve the problem of the ecological optimization of agriculture. Mechanical tillage, which is the basis of most agricultural technologies, has a dual impact on the soil. On the one hand, it contributes to the creation of favorable conditions for plant growth and ensures optimal crumbling and structure of the cultivated layer. On the other hand, intensive mechanical tillage can lead to the destruction of soil structure, disturbance of air and water balance, especially when tilling excessively wet or overly dry soils, as well as to the intensification of the mineralization of organic matter. Thus, depending on the method, depth, and frequency, mechanical tillage can act both as a factor improving the soil environment and as a cause of its degradation.

In the cultivation of grain, industrial, and forage crops, most farms seek to optimize costs while treating the land carefully by applying scientifically based crop rotations, organic fertilizers, soil protection from erosion, and other important agrotechnical measures. Every year, the issue of accumulating and conserving moisture in the soil becomes more acute. Under such conditions, soil tillage plays a leading role both in crop formation and in preserving and increasing soil fertility. Only through mechanical influence on the soil by the working elements of various machines and implements can optimal conditions for the development of the root system of cultivated plants be created and the efficient use of fertilizers and plant protection products ensured. It is known that up to 30–35% of fuel in the technological chain of growing field crops is spent on soil preparation. This is where a significant reserve for resource savings exists, which, together with the need to preserve soil

fertility, stimulates the search for alternative technologies instead of traditional plowing [1].

It is generally recognized that plowing, despite its important role in agriculture, is one of the most powerful factors of soil degradation. In dry years, moldboard technology contributes to accelerated moisture loss, which leads to a decrease in the potential productivity of crops. In addition, autumn plowing for spring crops is often complicated by unfavorable weather conditions that force work to be carried out within limited time periods. For this reason, non-moldboard tillage technology is considered a promising alternative to traditional plowing. This method of tillage is becoming increasingly widespread due to its soil-protective role, lower energy intensity, and high productivity.

The system of non-moldboard soil tillage includes several main technologies, among which minimal, strip, and zero tillage are distinguished. Minimal tillage (Mini-till) involves shallow soil loosening with disc or sweep tools with uniform mixing of plant residues with the upper soil layer to a depth of about 7–9 cm. This method reduces energy costs, preserves soil structure, and increases its moisture-accumulating capacity. The annual moisture accumulation effect of such tillage can reach 30–50 mm, which is especially important for regions with insufficient moisture.

Another type of non-moldboard tillage is the strip system (Strip-till), which involves vertical cultivation of individual soil strips to a depth of 15–17 cm, where crops are later sown. This method combines the advantages of traditional and minimal tillage, since part of the field remains undisturbed, which helps preserve the natural soil structure and its biological activity.

The most radical form of non-moldboard tillage is the No-till system, or zero tillage. It involves the complete rejection of mechanical soil loosening, except for the operation of creating a seedbed during sowing with special direct-seeding machines. One of the basic scientific principles of this system is the mandatory retention of all plant residues on the soil surface and their uniform distribution. Plant residues act as a mulch layer that protects the soil from overheating, reduces moisture evaporation, and contributes to the accumulation of organic matter. The transition to the No-till technology changes the very philosophy of agriculture, since soil fertility should increase naturally through the formation of a stable agroecosystem.

Non-moldboard tillage systems are widely used in many countries around the world. For example, in the United States such technologies are used on approximately 19.7% of sown areas, in Brazil — 45%, in Argentina — 50%, and in Paraguay — 60%. In Canada this figure is about 60%, while in Australia it reaches up to 90%. In Ukraine, reliable statistical data are lacking, but it is known that about 60% of arable land is still cultivated using moldboard plowing. At the same time, Ukrainian chernozems are considered among the most suitable soils for the implementation of the No-till system [3].

An important element of non-moldboard tillage is also deep soil loosening with chisel implements. Such tillage is recommended on soils prone to water erosion, as well as in areas with temporary surface waterlogging. It promotes the penetration of water into deeper soil layers, eliminates compaction, and improves the water-air regime. Studies show that replacing plowing with non-moldboard tillage reduces soil washout threefold and wind erosion by 1.5–2 times. In dry years, on light soils, non-moldboard tillage increases the moisture content of the fertile layer by approximately 3%, which positively affects the overwintering of winter crops and increases their yield.

Mulching the soil with plant residues is also of particular importance. Such a mulch layer improves the physical condition of the soil, increases its microbiological activity, and contributes to the preservation of humus. Plant residues covering the field surface protect the soil from overheating during dry periods and reduce moisture losses. Studies show that the drier the growing conditions, the greater the advantage of non-moldboard tillage compared to traditional plowing.

In modern agriculture, the improvement of machinery for non-moldboard tillage also plays an important role. For example, the German company Köckerling has specialized in the production of machines for such technologies for more than 50 years. One of the well-known implements is the VECTOR cultivator, which combines the functions of a cultivator and a deep ripper. The tines of the implement are arranged in four rows, ensuring high-quality soil mixing and uniform distribution of plant residues. The frame structure is very strong and can withstand high loads when working at high speeds. Double springs with a release force of up to 700 kg are installed on the tines, ensuring stable maintenance of the set tillage depth.

The cultivator is equipped with a hydraulic adjustment system that allows the working depth to be changed directly from the tractor cab. The double STS roller ensures high-quality soil reconsolidation, crushes clods, and levels the field surface. Due to the high frame clearance, the implement can operate in fields with a large amount of plant residues without clogging the working elements. In addition, the cultivator can be equipped with systems for applying mineral fertilizers or sowing cover crops, which allows several technological operations to be performed in a single pass.

Practical experience of farms demonstrates the effectiveness of using such implements. For example, in the farm POSP "im. Ivana Franka", the VECTOR cultivator is used for primary soil cultivation after harvesting grain crops. The implement cultivates stubble to a depth of 5–8 cm, which allows moisture to be retained in the soil and stimulates the germination of volunteer plants. After harvesting corn, the implement simultaneously cultivates the soil and applies fertilizers to a depth of 15–20 cm. Due to its design features, plant residues are evenly mixed with the soil throughout the entire working depth, which promotes the activity of soil microorganisms and improves soil structure [2, с. 31].

Thus, non-moldboard soil tillage is an important direction in the development of modern agriculture. It allows reducing energy and fuel costs, preserving soil moisture, decreasing erosion processes, and increasing soil biological activity. The application of such technologies contributes to improving soil fertility and ensuring more stable crop yields. For this reason, non-moldboard technologies are gradually becoming an effective alternative to traditional plowing and an important element of the sustainable development of agricultural production.

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ПІДТРИМКА КОМАНДНОГО ДУХУ В СПОРТІ

У роботі розглянуто особливості формування командного духу у спортивному колективі. Проаналізовано роль згуртованості, взаємодії між спортсменами, ефективної комунікації та розподілу ролей у команді. Визначено основні фактори, що впливають на рівень командної єдності, а також значення діяльності тренера у створенні позитивного психологічного клімату. Окрему увагу приділено зв'язку між рівнем згуртованості команди та результатами її виступів у змаганнях, а також методам командоутворення, що сприяють підвищенню ефективності спільної діяльності спортсменів.

Ключові слова: *командний дух, згуртованість команди, спортивний колектив, взаємодія спортсменів, комунікація, командоутворення, спортивна психологія.*

The paper examines the formation of team spirit within a sports team. The role of cohesion, interaction between athletes, effective communication, and role distribution within the team is analyzed. The main factors influencing the level of team unity are identified, as well as the importance of the coach's role in creating a positive psychological climate. Special attention is paid to the relationship between team cohesion and competition performance, as well as to team-building methods that improve cooperation and the effectiveness of joint activities among athletes.