

UDC 633.15:631.5

DOI <https://doi.org/10.32848/agrar.innov.2026.35.52>

## YIELD OF COMMON CORN DEPENDING ON GROWING CONDITIONS

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**Statement of the problem.** In the context of modern climate change, the issue of adapting corn growing technology is becoming particularly relevant, since this crop is characterized by high sensitivity to fluctuations in temperature and moisture levels. Adaptation of technological elements should be comprehensive and include crop rotation, tillage system, mineral nutrition, selection of hybrids by maturity groups (FAO), optimization of sowing dates and rates according to soil and climatic zones, as well as improvement of the plant protection system against weeds, pests and diseases. It is the consistency of these components that determines the ability of agricultural technology to compensate for the negative impact of abiotic and biotic stresses and ensure the stability of crop yields [3].

Corn is grown practically throughout Ukraine, including regions with an increased risk of drought or so-called physiological soil dryness. Under such conditions, obtaining high and stable yields is possible only by adhering to clearly regulated requirements for cultivation technology, which take into account limited moisture resources and the specifics of the soil cover. Insufficient adaptation of technology to extreme weather conditions, as a rule, leads to a significant decrease in the efficiency of using the biological potential of the crop.

In this regard, special attention should be paid to the risk management system, which includes a well-founded selection of hybrids, optimization of technological operations, and timely response to changes in growing conditions. Corn is one of the crops that is extremely sensitive to violations of agricultural technology, and under adverse hydrothermal conditions this dependence increases, which leads to a sharp increase in crop losses even with minor technological deviations [7].

One of the key technological methods for adapting to arid conditions is optimally early sowing, which allows for the most efficient use of soil moisture reserves accumulated in the autumn-winter period. At the same time, the seed sowing rate should be adjusted depending on the actual level of soil moisture: in case of moisture deficiency, it is advisable to reduce it in order to reduce intra-coenotic competition between plants.

Under conditions of limited water supply, it is important to minimize the effects of other stress factors, which requires the use of starter fertilizers, primarily containing available forms of nitrogen and phosphorus, as well as careful weed control using mild herbicides. The use of harsh herbicide regimens, especially in the early stages of development, can suppress crop growth and delay its development by 1–2 weeks, which is critical in dry years.

Another important area of drought resistance management of agrocenosis is the use of specialized

drought-resistant hybrids. However, practical experience shows that most of these hybrids show an advantage mainly in years with a pronounced moisture deficit, while in conditions favorable for moisture, they are often inferior in yield to intensive-type hybrids. Thus, the producer is forced to seek a compromise between reducing the risk of crop failure in dry years and the ability to realize maximum productivity potential under favorable weather conditions. At the same time, modern breeding progress has allowed the creation of hybrids capable of producing high yields both in conditions of deficit and sufficient moisture, which significantly expands the possibilities of adapting cultivation technology [1].

Modern corn hybrids are characterized by extremely high productivity potential, which for silage can reach 70 t/ha of green mass, and for grain – 14 t/ha and more, even without the use of irrigation. However, the realization of such potential is possible only under the condition of an optimal combination of agroecological and technological factors. The most important of these are the availability of moisture, the water-holding capacity of the soil, its structural condition, the content of nutrients and the level of acidity, which together form the conditions for the growth and development of plants [4].

The process of forming a corn crop actually begins with the correct choice of a hybrid, which must meet the technological capabilities of the farm, be adapted to the specific climatic conditions of the region, and ensure the achievement of physiological ripeness within the growing season. Soil quality, although it has a somewhat smaller impact than weather conditions and agricultural techniques, also plays a role in shaping the final result. After selecting a hybrid, it is especially important to follow the recommendations for its cultivation exactly.

Obtaining consistently high corn yields is one of the key tasks of modern crop production, however, its implementation is complicated by a combination of agrotechnical, soil-climatic, phytosanitary, and biological factors. Despite the high genetic potential of modern hybrids, the actual productivity of crops often does not correspond to the capabilities of the crop, which is due to the inconsistency of individual elements of cultivation technology with the specific conditions of agroecosystems.

One of the basic factors in shaping corn yield is the level of plant supply with mineral nutrients and the balance of the fertilization system. Studies conducted in the Western Forest-Steppe of Ukraine convincingly demonstrate that insufficient or unbalanced mineral nutrition significantly limits the intensity of growth processes and the accumulation of dry aboveground mass, which is directly reflected in the level of grain yield. It has been established that increasing



the rates of mineral fertilizers in combination with foliar feeding with micronutrients ensures more active development of the assimilation apparatus and contributes to the formation of higher crop productivity [7, 8].

At the same time, violation of optimal agricultural engineering parameters, in particular, simplification or inappropriate use of basic tillage systems, remains one of the common problems in corn cultivation. Insufficient cultivation depth or its inconsistency with soil and climatic conditions leads to a deterioration in the soil water regime, a decrease in the availability of nutrients, and a weakening of growth processes, which limits the realization of the crop's yield potential.

An important factor in the formation of yield is also the predecessor crop, which determines the reserves of productive moisture, the nutrient regime of the soil, and the phytosanitary condition of the agrocenosis. It has been proven that growing corn after unfavorable predecessors, in particular sunflower, is accompanied by a decrease in grain yield compared to its placement after cereal crops or corn. Under such conditions, there is a deterioration in plant growth rates and a decrease in individual ear productivity [5, 6].

This problem is exacerbated in conditions of intensive saturation of crop rotations with corn, which limits the possibilities of natural regulation of the number of harmful organisms and contributes to the accumulation of infectious agents in the soil. Repeated and constant sowing disrupts the ecological balance of agrophytocenoses, which negatively affects the stability of crop formation [2].

The unequal reaction of corn hybrids of different maturity groups to growing conditions is also one of the factors of yield instability. Mid-ripening and mid-late hybrids are usually characterized by higher productivity potential, but at the same time are more sensitive to nutrient deficiencies, unfavorable predecessors, and phytosanitary risks. Under unfavorable agronomic conditions, these features lead to a decrease in the efficiency of using the biological potential of the crop [5, 6].

An extremely important condition for successful corn cultivation is the correct choice of hybrids, the importance of which is only growing every year. The decisive factors are the compliance of hybrids with the level of technology intensity, their drought resistance and the ability of the grain to quickly release moisture. The last two characteristics are often in a certain antagonism, which requires a balanced approach when choosing hybrids for specific farming conditions [5].

**Materials and research methodology.** Field studies to assess the yield of common corn hybrids were conducted in the fields of the Continental Farmers Group company using generally accepted methods.

**Results and discussion.** The obtained research results indicate that the formation of corn yield in the conditions of the Western Forest-Steppe of Ukraine in 2022–2025 was determined by the complex interaction of hydrothermal conditions of the growing season and the biological characteristics of the studied hybrids. Analysis of weather factors in combination with agrometeorological indices and actual yield indicators allowed not only to assess the general

patterns of climate influence, but also to identify differences in the response of individual hybrids to variability in moisture conditions.

It was found that the variation of the Selyaninov hydrothermal coefficient within the range of 1,25–1,52 had only a weak positive relationship with the average corn yield ( $r = 0,07$ ). This confirms that in the absence of severe drought, the overall level of heat and moisture supply is not a determining factor in yield formation. At the same time, a more detailed analysis of yield by individual hybrids showed that their productivity depended largely on the ability to adapt to intra-seasonal variability in weather conditions (Fig. 1).

In a relatively dry year (GTC = 1,25), but with the lowest value of the stress index of uneven precipitation (54,4 %), most hybrids provided a stable level of yield. Thus, hybrids R 8834, YUNI 3511 and DK 315 produced a yield of over 11,0 t/ha, which indicates their good adaptability to moderate moisture deficit provided its uniform supply. In contrast, the less productive hybrid DKS 3805 was characterized by a significantly lower yield level, indicating a limited ability to realize potential even with a relatively favorable distribution of precipitation.

In 2023, which was distinguished by the most favorable combination of heat and moisture (GTC = 1,52; moisture index = 0,152), the yield of all hybrids increased. The highest indicators were recorded in the hybrids DK 315, YUNI 3511 and R 8834, whose yield exceeded 11,5–12,0 t/ha. This indicates the high ability of these hybrids to realize their yield potential under optimal hydrothermal conditions. However, even this year, there was some differentiation in productivity between hybrids, which may be due to differences in their resistance to high humidity and the associated phytopathological load.

In 2024, with close to optimal GTC values (1,36), but with an increased stress index of uneven precipitation (78,9 %), the yield of hybrids generally remained high, but its variability between hybrids increased. Thus, the hybrids DK 315 and P 8834 maintained a high level of productivity (over 12,0 t/ha), while the hybrids YUNI 3511 and EXPM 012 showed a certain decrease in yield. This indicates that under conditions of uneven moisture, the role of genetically determined resistance of hybrids to water stress and their ability to maintain a stable water balance increases.

The most contrasting results were obtained in 2025, which was characterized by extremely high precipitation unevenness (CV = 115,4 %) with a relatively high overall moisture level (GTC = 1,46). Under these conditions, the yield of all hybrids decreased significantly, but the degree of decrease was different. Hybrids DK 315, P 8834 and RZhT Lipekks maintained a relatively higher yield level (9,8–10,4 t/ha), while hybrids YUNI 3511 and EXPM 012 showed a more sharp drop in productivity. This indicates differences in the adaptive potential of hybrids to sharply contrasting moisture conditions and confirms the determining role of water regime stability for yield formation.

The established strong negative correlation between the stress index of uneven rainfall and average yield ( $r = -0,77$ ) is also confirmed by the analysis of the response of individual hybrids. Hybrids that showed less yield decline

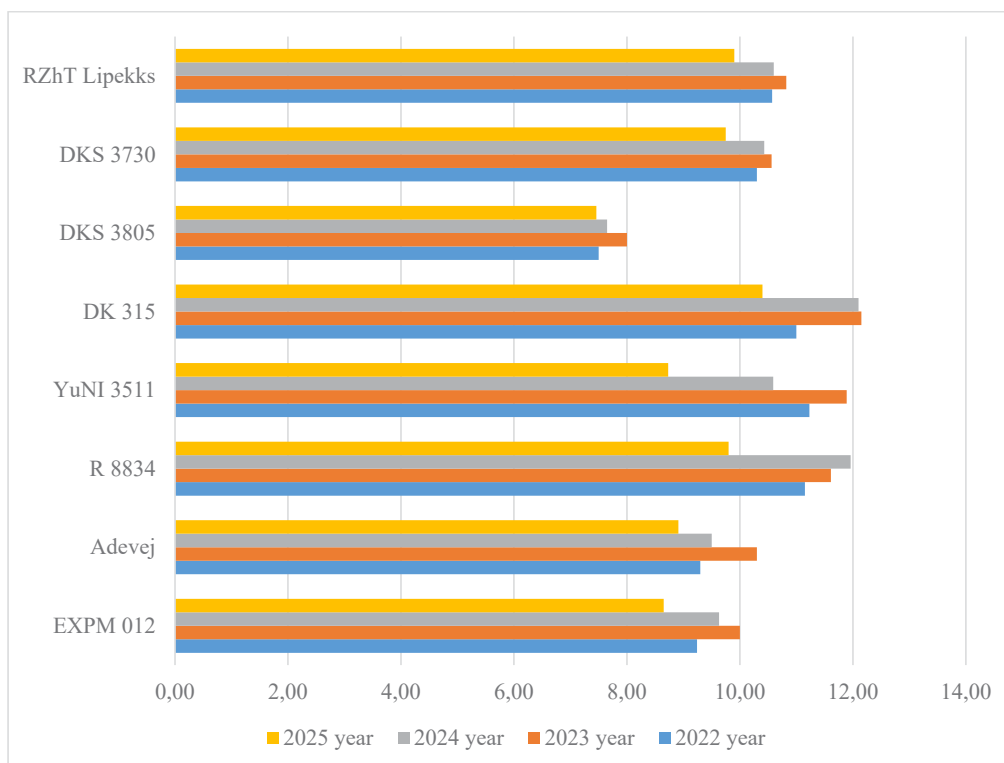


Fig. 1. Yield of common corn hybrids, t/ha

in years with high precipitation variability can be considered more adaptive to modern climatic fluctuations. At the same time, hybrids with a sharp decline in productivity under such conditions require either correction of elements of cultivation technology or limited use in regions with a high risk of uneven moisture.

Thus, the research results confirm that in the conditions of the Western Forest-Steppe of Ukraine, the realization of the yield potential of corn is determined not only by the level of general moisture, but also by the ability of specific hybrids to adapt to the uneven distribution of precipitation. The revealed patterns are of important practical importance for the selection of hybrids with increased ecological plasticity and for the optimization of corn cultivation technologies in conditions of increasing climatic variability.

**Conclusions.** The level of corn yield in the conditions of the Western Forest-Steppe of Ukraine is determined not so much by the total level of moisture, but by the nature of the distribution of atmospheric precipitation during the growing season. This is confirmed by the weak relationship between the Selyaninov hydrothermal coefficient and yield ( $r = 0,07$ ) and at the same time a strong negative correlation between rainfall irregularity and crop productivity ( $r = -0,77$ ).

Corn hybrids differ significantly in their ability to realize yield potential under conditions of hydrothermal variability. In years with increased rainfall variability, the most stable yields were provided by hybrids with higher adaptability to water stress, while less plastic genotypes were characterized by a significant decrease in productivity, which emphasizes the importance of breeding and selection of hybrids taking into account climatic risks.

Increasing climate variability increases the role of adaptive properties of hybrids and the stability of agroecological conditions as key factors in corn productivity. The results obtained indicate the feasibility of focusing modern cultivation technologies not only on ensuring the optimal moisture level, but also on reducing the negative impact of uneven moisture through the selection of resistant hybrids and adaptation of agricultural engineering elements.

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**Shishkin B.M. Yield of common corn depending on growing conditions**

Field studies to assess the yield level of common corn hybrids were conducted under production conditions in the fields of the Continental Farmers Group company, following generally accepted methods of field experiments and statistical processing of results. This approach ensured the representativeness of the obtained data and the possibility of their correct generalization for the conditions of the Western Forest-Steppe of Ukraine. The results of the research showed that the formation of corn yield in 2022–2025 was determined by the complex and multifactorial interaction of hydrothermal conditions of the growing season and the biological characteristics of the studied hybrids. The combination of weather analysis with the calculation of agrometeorological indices and actual yield data made it possible not only to establish general patterns of the influence of climatic factors, but also to identify significant differences in the reaction of individual hybrids to the variability of moisture conditions during the growing season. It has been established that the level of corn productivity in the conditions of the Western Forest-Steppe of Ukraine is determined mainly not by the total amount of precipitation, but by the nature of its spatial and temporal distribution during critical phases of plant development. This is confirmed by the weak correlation between the Selyaninov hydrothermal coefficient and yield ( $r = 0,07$ ), which indicates the limited informativeness of this indicator under conditions of uneven moisture. At the same time, a strong negative correlation was established between the precipitation unevenness index and the level of corn yield ( $r = -0,77$ ), which indicates the determining role of intraseasonal variability of water supply in shaping crop productivity. The studied corn hybrids differed significantly in their ability to realize yield potential under conditions of hydrothermal instability. In years with increased rainfall irregularity, the most stable yield indicators were provided by hybrids with a higher level of adaptability to water stress, while less plastic genotypes were characterized by a significant decrease in productivity. This emphasizes the importance of breeding hybrids with increased ecological plasticity and resistance to abiotic stresses. In general, increasing climate variability increases the importance of the adaptive properties of hybrids and the stability of agroecological conditions as key factors in shaping corn yields. The results obtained indicate the

feasibility of focusing modern cultivation technologies not only on achieving the optimal level of moisture supply, but also on reducing the negative impact of uneven distribution of precipitation through targeted selection of resistant hybrids and adaptation of the main elements of agricultural technology.

**Key words:** common corn, hybrid, yield, precipitation, temperature.

**Шишкін Б.М. Урожайність кукурудзи звичайної залежно від умов вирощування**

Польові дослідження з оцінки рівня урожайності гібридів кукурудзи звичайної проводилися у виробничих умовах на полях компанії «Контінентал Фармерз Груп» із дотриманням загальноприйнятих методик польового дослідження та статистичної обробки результатів. Такий підхід забезпечив репрезентативність отриманих даних і можливість їх коректного узагальнення для умов Західного Лісостепу України. Результати досліджень засвідчили, що формування урожайності кукурудзи у 2022–2025 рр. визначалося складною та багатофакторною взаємодією гідротермічних умов вегетаційного періоду й біологічних особливостей досліджуваних гібридів. Поєднання аналізу погодних показників із розрахунком агрометеорологічних індексів та фактичними даними урожайності дало змогу не лише встановити загальні закономірності впливу кліматичних чинників, а й виявити істотні відмінності в реакції окремих гібридів на варіабельність умов зволоження впродовж вегетації. Установлено, що рівень продуктивності кукурудзи в умовах Західного Лісостепу України зумовлюється переважно не загальною кількістю атмосферних опадів,

а характером їх просторово-часового розподілу протягом критичних фаз розвитку рослин. Це підтверджується слабким кореляційним зв'язком між гідротермічним коефіцієнтом Селянінова та урожайністю ( $r = 0,07$ ), що свідчить про обмежену інформативність цього показника за умов нерівномірного зволоження. Водночас встановлено сильний негативний кореляційний зв'язок між індексом нерівномірності опадів і рівнем урожайності кукурудзи ( $r = -0,77$ ), який вказує на визначальну роль внутрішньосезонної мінливості водозабезпечення у формуванні продуктивності культури. Досліджувані гібриди кукурудзи суттєво різнилися за здатністю реалізовувати врожайний потенціал за умов гідротермічної нестабільності. У роки з підвищеною нерівномірністю опадів найбільш стабільні показники урожайності забезпечували гібриди з вищим рівнем адаптивності до водного стресу, тоді як менш пластичні генотипи характеризувалися істотним зниженням продуктивності. Це підкреслює важливість селекційного добору гібридів із підвищеною екологічною пластичністю та стійкістю до абіотичних стресів. Загалом зростання кліматичної мінливості посилює значення адаптивних властивостей гібридів і стабільності агроекологічних умов як ключових чинників формування врожайності кукурудзи. Отримані результати свідчать про доцільність орієнтації сучасних технологій вирощування не лише на досягнення оптимального рівня вологозабезпечення, а й на зниження негативного впливу нерівномірного розподілу опадів шляхом цілеспрямованого добору стійких гібридів та адаптації основних елементів агротехніки.

**Ключові слова:** кукурудза звичайна, гібрид, урожайність, опади, температура.

Дата першого надходження статті до видання: 02.02.2026  
Дата прийняття статті до друку після рецензування: 30.03.2026  
Дата публікації (оприлюднення) статті: 06.05.2026