UO‘T: 631.816.36

EFFICIENCY OF PORTABLE SPRAYING SYSTEMS IN WATER AND NUTRIENT APPLICATION TO WINTER WHEAT

ЭФФЕКТИВНОСТЬ ПОРТАТИВНЫХ РАСПЫЛИТЕЛЬНЫХ СИСТЕМ ПРИ ВНЕСЕНИИ ВОДЫ И ПИТАТЕЛЬНЫХ ВЕЩЕСТВ В ОЗИМУЮ ПШЕНИЦУ.

Pulatov Fozilxon Ergash o‘g‘li
Assistant Department of Plant Science, Soybean and Oilseed Crops, Andijan Institute of Agriculture and Agrotechnologies,
Ubaydullayev Urayimjon Shuxrat o‘g‘li
Student Andijan Institute of Agriculture and Agrotechnologies

Abstract. The article analyzes the advantages of a mobile spraying system aimed at increasing the efficiency of nutrient use in grain crops. The system provides microdisperse spraying by holding the sprayer hose at a certain height using air-filled ball-shaped supports. This method reduces water consumption, evenly distributes the spray onto the leaf surface, and increases the fertilizer utilization ratio.

Keywords: winter wheat, microdisperse spraying, water saving, foliar feeding, mobile system.

Аннотация. В статье анализируются преимущества мобильной системы опрыскивания, направленной на повышение эффективности использования питательных веществ в зерновых культурах. Система обеспечивает микродисперсное опрыскивание за счет удержания шланга опрыскивателя на определенной высоте с помощью наполненных воздухом шарообразных опор. Этот метод снижает потребление воды, равномерно распределяет распыляемое вещество по поверхности листьев и повышает коэффициент использования удобрений.

Ключевые слова: озимая пшеница, микродисперсное опрыскивание, водосбережение, внекорневая подкормка, мобильная система.

Firstly, if we focus on foliar feeding in the cultivation of cereal crops, almost all crops are traditionally fertilized through the roots. Nevertheless,

nowadays, high yields are increasingly achieved by supplying nutrients through the leaves. Roots cannot deliver all the necessary macro- and microelements to the plant. There are several reasons for this, such as soil alkalinity, salinity, acidity, and other factors that limit nutrient uptake by plants. For example, when nitrogen or potassium levels increase, they can displace $Ca(NO_3)_2$ in the soil, making calcium unavailable for plant absorption.

In such cases, the plant cannot acquire all the nutrients it needs through its roots alone. To prevent this, foliar feeding is applied. Plants should be fertilized through the leaves at least every 10–14 days. Another reason for foliar feeding is that it allows for the rapid correction of any nutrient deficiency. Nutrients applied to the leaves quickly reach the plant tissues, roots, and fruits.

Typically, when fertilizing via the roots, we mainly use phosphorus, potassium, and nitrogen. The same elements are also used in foliar feeding. However, applying nitrogen or potassium separately does not yield effective results; phosphorus, potassium, and nitrogen should be applied together. Conversely, if these elements are applied individually, they are poorly absorbed through the leaf surfaces, and their effect is negligible [1].

When applying foliar fertilization, it should be done every 10–15 days in the form of fine water droplets, ensuring coverage of the upper, lower, and main parts of the leaves. Using other methods or excessive spraying on the leaves can cause leaf burn. The doses of micro- and macroelements applied via foliar feeding should be lower than those applied through the roots, as excessive amounts can have harmful effects on the plant. Foliar fertilization primarily contributes to increased yield, improved resistance to diseases and pests, and enhanced drought tolerance. The optimal time for spraying fertilizers on leaves is early morning or late evening, when humidity is high and plant cells are fully turgid, meaning they are filled with water. Conversely, spraying during the hot part of the day can negatively affect the plant, leading to leaf burn. Therefore, timing is a critical factor in foliar feeding [2].

Specifically, achieving high yields in winter wheat depends on providing the plant with sufficient nutrients throughout its vegetative period. In traditional soil-based fertilization, a portion of the nutrients becomes bound in the soil or is leached away. Therefore, foliar feeding is an effective method for delivering nutrients directly to the plant. However, when applying foliar sprays, factors such as droplet dispersion, spray height, and uniformity of coverage are critical for effectiveness.

For the cereal crops we are developing, using a foliar spraying system equipped with air-assisted nozzles or applying various protective agents offers several advantages compared to conventional methods, such as tractor-based field operations or the increasingly popular use of drones. These advantages include more precise nutrient delivery, reduced environmental losses, and potentially higher efficiency in reaching all plant surfaces.

Indicator	**Gigant ballon-Assisted Mobile Sprayer**	**Drone Spraying**
Spray height	40–60 cm, stable	2–4 m, variable
Drift (wind displacement)	Very low	High
Leaf coverage	Very uniform	Uneven
Solution consumption	Low (micro-dispersion)	Higher requirement
Operating time	Continuous	Limited by battery
Field coverage	Covers large areas quickly	Small sectors
Cost	Low (fuel + pump)	High (drone, battery)

Indicator	**Gigant ballon-Assisted Mobile Sprayer**	**Tractor Sprayer**
Crop damage	None	Present
Soil compaction	None	High
Operation on wet soil	Possible	Difficult
Spray height	Stable	Uneven (terrain-dependent)
Leaf coverage	High	Moderate
Losses	Low	High

A mobile spraying system supported by air-assisted rollers and maintained at a height of 40–60 cm above the field surface offers significant advantages for foliar nutrient application compared to drones and tractor-mounted sprayers.

Firstly, the low and consistent spray height preserves droplet dispersion. In drone spraying, the spray height is typically around 2–4 meters, and as the droplets descend, wind can displace them, reducing the uniformity of coverage. As a result, leaf surfaces are covered unevenly, and a portion of the nutrients is lost. In contrast, in an air-assisted system, the nozzles are positioned very close to the leaves, allowing the spray to reach the plant surfaces in a fine mist, with minimal drift observed.

Secondly, there is a significant difference in operational efficiency. Drones are limited by battery capacity, operate for a short duration, and require recharging. In contrast, the mobile spraying system operates continuously with the help of a pump, covering large areas without interruption.

Compared to tractor-mounted sprayers, the main advantage is the absence of crop damage. When a tractor enters the field, wheel tracks form, wheat stems are bent, soil becomes compacted, and yield is negatively affected. In an air-assisted mobile system, the equipment does not enter the field; spraying is conducted from a distance, leaving the plants and soil unharmed.

Moreover, the consistent spray height ensures high leaf coverage, which allows for rapid and complete nutrient absorption. As a result, fertilizer and water usage is reduced while efficiency increases.

Economically, this method is also advantageous: it does not require heavy machinery, expensive drones, or batteries. High-quality spraying can be achieved using a simple pump, hose, and air-assisted support rollers.

Therefore, the air-assisted mobile spraying system represents a more precise, safer, and cost-effective technological solution for foliar fertilization compared to drone and tractor spraying methods.

The large air-assisted support rollers used in the mobile spraying system not only serve a technical function but also provide additional socio-economic

opportunities. Their considerable size (5–6 m in diameter) and sequential arrangement across the field create a visually striking effect. This transforms the system into not only an agrotechnical innovation but also a powerful visual communication tool.

The surfaces of these rollers can display logos of various companies, agricultural firms, fertilizer producers, seed companies, or agricultural machinery brands. As a result, the field itself becomes an open advertising space. In particular, fields located near roads make the rollers visible from a long distance, generating strong advertising impact. This creates an additional revenue stream for startup projects through advertising partnerships.

Furthermore, this system serves as an interesting attraction for agrotourism. Typically, technological processes in the field are not visually appealing. However, a spraying system equipped with large red rollers creates an unusual and eye-catching landscape that draws attention. Students, farmers, researchers, and the general public have the opportunity to observe the process firsthand and learn about this innovative method. This makes the system ideal for conducting practical seminars, live demonstrations, and “Field Day” events.

Such visual innovations also increase young people’s interest in agriculture. Agriculture is often perceived as a conservative sector. Observing modern, unconventional, engineering-based solutions highlights the innovative and technological aspects of the field, helping promote agriculture as a contemporary and attractive profession.

Another key aspect is the dissemination of scientific and startup projects. Field demonstrations equipped with these rollers are highly photogenic for social media, mass media, and video content. The strong visual effect helps the project gain rapid visibility and attracts the attention of investors and collaborators.

Thus, the air-assisted support rollers function not only as a mechanical component of the spraying system but also as a tool for advertising, agrotourism, educational demonstration, and the popularization of agriculture. This significantly

enhances the social and economic value of the startup project alongside its technical efficiency.

References

1. Pulatov F. Using resource-efficient irrigation methods in the fergana valley. Экономика и социум. 2025. 2-1 (129) 437-440
2. FAO (Food and Agriculture Organization of the United Nations). (2017). *Good Agricultural Practices for Field Crops*. FAO Publications.