EXPERIMENTAL RESULTS OF A DISC PLOUGH EQUIPPED WITH A SCRAPER

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The tests of the disc plough equipped with a scraper (moldboard) were conducted in comparison with the existing PLN 3-35 mouldboard plough on a field of the QXMITI Institute’s experimental station, previously used for growing winter wheat. Both ploughs were aggregated with a New Holland TD 5.110 tractor and tested at forward speeds of 6 and 9 km/h.

According to standard regulatory documents, the following indicators were measured for both ploughs: working width, tillage depth, soil crumbling quality, completeness and depth of weed burial, height of surface irregularities formed after ploughing, and specific draft resistance.

To determine the operational productivity and fuel consumption of the ploughs, special chronometric measurements were carried out. These included the area tilled within the unit of operating time, the amount of fuel consumed, and the coefficients of shift and operational time utilization.

Figure 1. View of the Operating Process of the Disc Plough Equipped with a Scraper

The analysis showed that, at both forward speeds, the agrotechnical performance indicators of the tested ploughs fully met the initial requirements. However, when using the disc plough equipped with a scraper (moldboard), the work productivity was 1.1–1.2 times higher compared to the PLN-3-35 mouldboard plough, and fuel consumption per hectare of ploughed land was reduced by 3.52–2.95 kg.

This is mainly due to the fact that the disc plough with a scraper offers lower draft resistance compared to the PLN-3-35 mouldboard plough and operates more reliably without clogging from plant residues.

It should also be noted that the disc plough with a scraper provided better soil crumbling quality than the mouldboard plough. Specifically, the proportion of soil fractions smaller than 50 mm was 3.9–4% higher, while the proportion of fractions larger than 100 mm was 3.7% lower in the areas tilled by the disc plough.

Moreover, when the forward speed was increased from 6 to 9 km/h, the increase in specific draft resistance for the disc plough with a scraper was slightly lower than that of the mouldboard plough: the draft resistance of the mouldboard plough increased by a factor of 1.1, whereas for the disc plough with a scraper it increased only by a factor of 1.03.

This can be explained by the following working process: the soil slice is cut and fragmented by the working tool of the disc plough, then strikes against the scraper, where it undergoes additional disintegration. The fragmented slice continues to move along the scraper's working surface, is ejected, and lands at the bottom of the furrow formed by the preceding disc body. As a result, complete inversion of the soil slice and full burial of plant residues are achieved.

This effect is primarily due to the rotary action of the working tool of the disc plough equipped with a scraper, which leads to a reduction in the impact forces exerted by the soil slice on the tool.

Conclusion. Based on the conducted research, it was confirmed that the disc plough equipped with a scraper (moldboard) reliably performs the designated process, and its performance indicators fully comply with the established requirements.

When the disc plough with a scraper is used, its productivity increases by a factor of 1.1–1.2 compared to the conventional PLN-3-35 mouldboard plough, and fuel consumption per hectare is reduced by 3.52–2.95 kg.

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