

The Productivity and Ecology in Agriculture

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Abstract. The article provides recommendations that save land resources, increase and prevent the decline in soil fertility, when growing crops using mobile technical means. An increase in the productivity of agricultural units is inextricably linked with an increase in the mass of the tractor and aggregated agricultural machines, and, consequently, their negative technogenic impact on the soil increases. The purpose of the research is to solve problem of aggregation of sowing and cotton cultivators with four-wheeled tractors and increase their operational-technological performance. According to it, conditions for aggregation of processing units with a tractor are given. The results of scientific and practical research and testing to determine and evaluate performance of machine-tractor units (MTU) consisting of inter row spacing sowing and cultivators with four-wheel tractors were obtained and analyzed.

INTRODUCTION

Further development of cotton growing is impossible without improving the culture of farming, reducing the agro-terms of field processing, reducing the cost of production and increasing the productivity of mechanized labor by equipping agriculture with new modern equipment [1,2,3].

The productivity of mechanized labor in cotton growing for many years on the basis of three-wheel power has practically stabilized due to the achievement of operating speeds in all operations, limited by the quality indicators of the technological process. Long-term studies have established that an increase in labor productivity by 1.2-1.5 times MTU in cotton growing can be achieved by creating eight-row complexes of machines for wide-row sowing, which in turn will require an increase in traction and the creation of more powerful tractors [4,5,6,7].

Thus, an increase in the productivity of agricultural units is inextricably linked with an increase in the mass of the tractor and aggregated agricultural machines, and, consequently, their negative technogenic impact on the soil increases [8,9,10,11]. As a result of the impact of the wheels of tractors and agricultural machines, the depth of soil compaction reaches 0.3-0.6 meters. The upper fertile layer is most strongly compacted.

MATERIALS AND METHODS

Features of the interaction of track mover (propulsion) of agricultural tractors and machines with the soil are due to the extraordinary conditions of their work, which consists in the fact that the supporting surface is the most complex biological environment, which has an invaluable property – fertility, i.e. ability to yield.

Table 1 shows the weight of CLAAS AXOS 340 tractor in transport state, aggregated with planting and tillage machines (Figure 1).

TABLE 1. Weight of MTU based on CLAAS AXOS 340 tractor (in transport position)

Condition al characters	Aggregate (Machine-tractor unit)	Operating weight, N (kg)		Mass attributable to propellers, N (kg)			
		Aggregate	MTU	To front wheels		To rear wheels	
				Right	Left	Right	Left
A	AXOS 340+GUNGOR pneumatic seeder	43360,2 (4420)	6965,1 (710)	6474,6 (660)	6474,6 (660)	15107,4 (1540)	15009,3 (1530)
B	AXOS 340+KZU-0.3 trencher	41398,2 (4220)	5101,2 (520)	6768,9 (690)	6768,9 (690)	13930,2 (1420)	13930,2 (1420)
V	AXOS 340+OMU 3 local fertilizer	42869,7 (4370)	7455,6 (760)	5886 (600)	5591,7 (570)	15597,9 (1590)	15794,1 (1610)
G	AXOS 340+MVH-5.4 hoe	40711,5 (4150)	4806,9 (490)	6965,1 (710)	6867 (700)	13537,8 (1380)	13341,6 (1360)

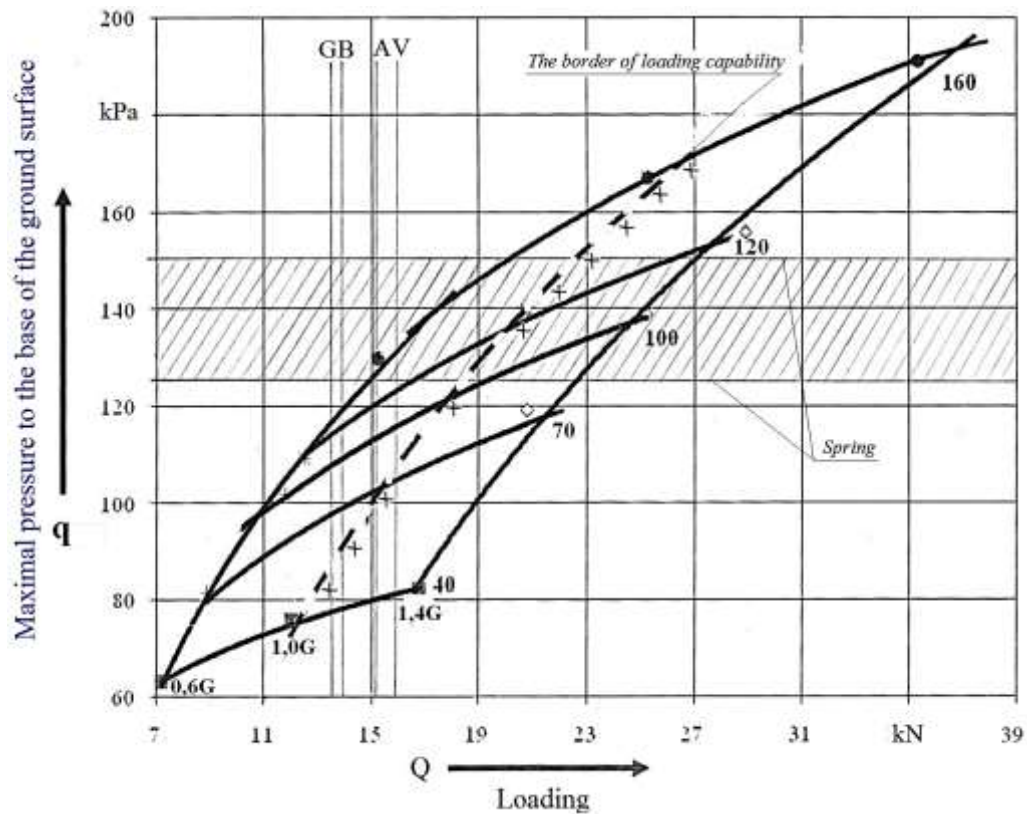


FIGURE 1. Dependence of the maximum pressure of the tire 420/85 R38 (16.9R38) on the contact surface at various loads and internal pressures

When tires 16.9R38 F-52 were installed on the rear wheels of the TTZ 1030 tractor and the MTU was formed on their basis, the pressure on the soil was studied and analyzed (Figure 2). In the spring season, for soil cultivation MTU only up to 21 kN at a pressure of 80 kPa and not more than 10-11 kN at 100 kPa, loading is allowed [2,3,6].



FIGURE 2. Method for determining the vertical forces attributable to the supporting surfaces and taking prints

The rear wheel tire of the CLAAS AXOS 340 420/85 R38 (Good Year) tractor, according to research results, can be used even with an internal pressure of 40 kPa, allowing you to enter the field with a load of up to 27 kN at a maximum pressure of 120 kPa for the spring season (Figure 1). Therefore, when choosing a tire for a tractor, it is advisable to pay attention to its elasticity, to tires with a high load at the lowest possible internal pressure. Because the more elastic the tire, the more its contact surface with the ground increases due to the change in internal pressure, and the pressure that it exerts on the ground decreases.

RESULTS AND DISCUSSION

Currently, abroad [12,13,14,15] to prevent soil compaction during inter-row cultivation, they use the installation of wide-profile highly elastic radial tires on wheeled tractors, the installation of tires in pairs or triples for each driving wheel, the use of continuous technological traces, and the complex, the use of technological traces of agricultural machines that perform several technological processes of work, and the use of tractors with rubber-metal tracks (Figure 3).



FIGURE 3. Aggregated agricultural machinery with powerful tractors that meets modern environmental requirements

When using tractors with metal or rubber chains to reduce soil compaction, they can be used for soil preparation for sowing, planting and inter-row cultivation with any complex combined implements due to the high engagement of the walking part with the ground. and the ability to create a large traction force [16,17,18].

The compaction and grinding of the soil (turning into dust) by the running systems of agricultural units from year to year, the blowing of small particles by the wind reduces the thickness of the fertile layer, which for the soils of Central Asia does not exceed 0.5 meters [16,17,19,20-25].

Due to a more rational distribution of the tractor mass over the supports and a reduction in the number of tracks per unit area (ha), a 4-wheeled tractor has clear advantages, including environmental ones, compared to a 3-wheeled one.

Research of the agricultural energy development sector of SRIME (Scientific-Research Institute for Agriculture) is aimed at creating a 4-wheel all-wheel drive energy-saturated tractor with increased maneuverability.

On the basis of a mock-up tractor, the parameters of the steering drive were developed and substantiated, which give a 4-wheeled universal row-crop tractor maneuverability that is not inferior to a 3-wheeled one [14,15,19,20,21].

Calculations show that the transition from the 3K2 wheel scheme, traditional for domestic cotton energy, to all-wheel drive energy, will reduce the weight of the tractor by 1.3 times without worsening the traction potential of the MTU.

CONCLUSION

A four-wheeled cotton-growing tractor will become suitable for transport, which will make it possible to increase its annual employment by more than 30%.

In addition to the above, the mock-up tractor design provides for the possibility of adjusting the track of the front and rear wheels, which makes it possible to have a single power source for various sowing patterns (60 cm and 90 cm).

The widespread replacement of obsolete agricultural machinery with a new one - soil-friendly, one of the samples of which is an experimental tractor, along with other reasonable measures in economic activity, will make it possible to avoid economic disasters like the Aral one.

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