Research Journal of Agricultural Science, 42 (1), 2010

RESEARCH CONCERNING THE RATIONAL LOAD OF THE POWER BASE UPON AGGREGATE FORMATION

Cornelia TONEA, Radu ILEA., Gheorghe DRĂGOI, Lorin PILOCA, Daniel POPA, Elenea TONEA

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Agricultural Sciences, Timisoara, Aradului Street, no. 119, RO-300645, Romania,
Corresponding author: corneliatonea@gmail.com

Abstract: *Optimal working regime of aggregates corresponds to the speed rate at which traction is maximal, and fuel consumption is minimal. Some works cannot be done at speed rates corresponding to the optimal regime since at these rates; the moving speed of the tractor is superior to the maximum speed at which agricultural machines can move. In this case, the optimal working regime of the aggregates is limited by the technological speed of the aggregate. During tractor exploitation, only part of the effective power of the engine is used to operate agricultural machines, the other one is lost because of the resistance forces that appear during tractor movement. In choosing a certain aggregate for a certain work, we need to take into account the main destination of the tractor or of the agricultural machines, of the possibility of making the works in agreement with agro-technical requirements, with a minimal fuel consumption and a high working capacity. The working speed of the aggregate is determined by agro-technical requirements and by the technological process of the agricultural machine. When agro-technical and technological requirements allow high-speed works with wide variation limits, working speed is chosen so that it corresponds to the maximal power of the tractor. The working caapcity of the fertiliser-spreading aggregates is largely influenced by the way in which the work is organised, since the duration of tank-filling and movements from filling points to the plot and vice-versa affects the duration of the effective work in the structure of the shift time. Tillage is the work with the highest share from the point of view of energy consumption and of the period of time tractors are used. To do the tillage, they need the highest amount of mechanical energy. Choosing aggregates for the preparation of soil for sowing is done depending on the physical and mechanical features of the soil, by soil moisture, by the land state at the time of work. In order to increase of the working caapcity of the sowing aggregates we recommend a better organisation of the works, taking into account the choice of the movement direction along the plot, the mandatory marking of the first route and the sue of markers to identify the following routes, ensuring the loading of the machines at one of the ends of the plots right on the place where the aggregate is starting working, and the supervision of seed distribution during the work.*

Key words**:** *aggregate, working width, working speed, working capacity;*

INTRODUCTION

Optimal working regime in tractors in aggregate with agricultural machines is established with the help of a power balance and it corresponds to the speed steps for which traction power is maximal, fuel consumption is minimal, and working capacity is maximal.

A tractor's traction power is one of the factors that influence largely the working capacity of the aggregates, determining the choice of the working width of the aggregate and of the working speed in accordance with the circumstances.

MATERIAL AND METHODS

Measuring exploitation parameters was done by using equipment and modern apparatuses such as:

- a device for the measuring of the tractor's moving speed and of the gliding coefficients of the wheels
- a device for the measuring of fuel consumption
- a device and apparatuses for the measuring of quality indices of works

RESULTS AND DISCUSSIONS

Field experiments were organised to get comparative results in aggregates of Some 60 HP and 45 HP tractors in the main works: ploughing on medium soil, preparing germination bed by total cultivation, sowing tillage crops, sowing straw cereals, spreading granulate chemical fertilisers and manure.

Thus, experiments were carried out on medium soil conditions with moisture between 18 and 20%.

Experiments were carried out with each aggregate in three replications on trial plots 100-m wide.

During the experiments, we measured the following representative indices: working width B (m), moving speed V1 (km/h), fuel consumption Ch (kg/h), real working capacity W (ha/h), and specific fuel consumption Cs.

At the same time, machines were fixed so at ensure similar quality works, no matter the tractor power.

Results of field trials are represented by the main indices in table 1 through 7.

Table 1.

Representative indices for tillage works

No.	Work	Aggregate	B m	Vl Km/h	C_h Kg/h	W Ha/h	C_s Kg/ha
1	Tillage A=20 cm	U445+PP2	0,5	5,86	6,80	0,298	21,18
2	Tillage	Some 60 + PP4-30	0,91	7,70	10,80	0,703	14,65

Table 2.

Representative indices for the disking

No	Work	Aggregate	B m	V_l km/h	C_h Kg/h	W Ha/h	C_s Kg/ha
1	Disking	U445+GDD-1,8	1,8	5,87	5,31	1,43	3,8
2	Disking	Some 60 + GDU 3,4	3,4	6,00	8,2	2,04	3,99

Table 3.

Representative indices for the total cultivation work

No.	Work	Aggregate	B m	V_l Km/h	C_h Kg/h	W Ha/h	C_s Kg/ha
1	Cultivation	U445+C-2,6	2,6	5,49	5,5	1,43	3,8
2	Cultivation	Some 60 + C-3,9	3,9	5,92	8,40	2,31	3,40

Table 4.

Representative indices for the sowing of tillage crops

No.	Work	Aggregate	B m	V_l Km/h	C_h Kg/h	W Ha/h	C_S Kg/h
1	Sowing	U445+SPC4	2,8	6,3	4,7	1,66	2,74
2	Sowing	Some 60 + SPC 8	5,6	5,4	5,1	3,03	1,85

Table 5.

Representative indices for the sowing of straw cereals

No.	Work	Aggregate	B m	V_l Km/h	C_h Kg/h	W Ha/h	C_S Kg/h
1	Sowing	U445 + SC-2	2,6	6,1	4,8	1,50	3,01
2	Sowing	Some 60 + SUP 29	3,6	6,0	6,2	2,26	2,80

Table 6.

Representative indices for the spreading of chemical fertilisers

No.	Work	Aggregate	B m	V_l Km/h	C_h Kg/h	W Ha/h	C_S Kg/h
1	Spreading of chemical fertilisers	U445+MIC 300	12	5,62	3,2	6,71	0,47
2	Spreading of chemical fertilisers	Some 60 +MA-3,5M	12	7,31	6,20	8,86	0,68

Table 7.

Representative indices for the spreading of manure

No.	Work	Aggregate	B m	V_l Km/h	C_h Kg/h	W Ha/h	C_s Kg/ha
1	Spreading of manure	U445+MIG 5	3,20	3,22	2,90	1,02	2,8
2	Spreading of manure	Some 60 +MIG 5	3,20	3,69	5,8	1,19	4,8

Analysing the data in Table 1 we can see that p

loughs had a working width close to the construction one, which shows that aggregates were well fixed. As for fuel consumption per ha, we can see that it decreases with the engine power decrease.

In disking (Table 2), we should note the increase of the working speed together with the increase of the tractor power, which results in an increase in productivity. It is obvious that in disking it is preferable to use aggregates formed of higher power tractors from the point of view of productivity and fuel consumption.

In total cultivation works (Table 3), we can see that for the nearly the same speed we get an increase of the fuel consumption capacity decreasing, which shows that working widths of cultivators and working speed increase were reasonable.

In the sowing of tillage crops (Table 4) we can see for different values of the working speed working capacity also increases and fuel consumption decreases.

In the sowing of straw cereals (Table 5) we can see that for relatively identical working speeds the working capacity increased and fuel consumption decreased in both aggregates.

In spreading granulate chemical fertilisers we used spreading machines with a single rotator disk which lead to the same working width in all aggregates, i.e. 12 cm (Table 6). Though the working speed of the aggregates increased with the increase of the tractors' power, there was a proportional increase of the working capacity and the fuel consumption per ha in this work increased with the increase of tractors' power.

As a result, due to the specificity of the spreaders by centrifugation, where working width does not increase proportionally with the tractors' power, fuel consumptions are smaller in aggregates formed of low power tractors. In spreading manure (Table 7), we can notice an increase of the specific consumption of fuel proportionally with the increase of tractors' power due to the preservation of the working width for all aggregates.

CONCLUSIONS

Analysing field experimental results of aggregates with 45 HP and Some 60 HP tractors used in the main agricultural works, we can draw the following conclusions:

In all agricultural works under study the real working capacity increases with the increase of the tractor's power.

From the point of view of the specific fuel consumption, the superiority of the Some 60 HP tractors is confirmed only for soil works and for sowing works.

Fuel consumption in aggregates for the spreading of chemical fertilisers and of manure was small in aggregates formed with 45 HP tractors to decrease in the case of aggregates formed with Some 60 HP tractors. This can be explained by the working principle of the spreaders in which working width does not increase with the increase of the tractor's power. As a consequence, it is preferable to use aggregates formed with 45 HP tractors in this work.

BIBLIOGRAPHY

1. CORNOIU N. 1993, Baza materială pentru executarea mecanizată a lucrărilor agricole, Rev.Mec.agr. nr. 1/1993
2. MIHĂIȚOIU I., CARACIUGIUC G., DEMETRESCU I. 1974, Utilizarea rațională a tractorului de 40-45 CP, Ed. Ceres București;
3. POPESCU S., 1979, Tehnologia exploatării tractoarelor şi maşinilor agricole, IP Braşov;
4. ȘANDRU A., 1983, Exploatarea utilajelor agricole, Ed.Did.şi Ped., Bucureşti, 1983;
5. TONEA CORNELIA 2003, Masini agricole si horticole, Ed. Agroprint;
6. TOMA D.N. , 1980 Productivitatea muncii la lucrările mecanizate. Ed. Ceres;