VARIATION OF TRACTORS' TRACTION POWER FORCE FUNCTION OF WORKING SPEED, SOIL AND PLOUGH TYPE AT SUPERFICIAL TILLAGE

VARIAȚIA PUTERII DE TRACȚIUNE A TRACTORULUI FUNCȚIE DE VITEZA DE LUCRU, TIPUL DE SOL ŞI TIPUL DE PLUG LA EFECTUAREA ARĂTURILOR SUPERFICIALE

AVARVAREI B. V.
University of Agricultural Sciences and Veterinary Medicine Iaşi

Abstract. *The present paper have as goal to establish the tractors' traction power force used by two different ploughings units at superficial tillage. U-650 tractor and PP-3-30 normal plough and the other one by U-650 tractor and PRP-3 reversible plough form the two units. The working conditions are as follows: three different types of soil (light soil, medium soil and heavy soil), four different working speeds (4.48 km/h, 4.61 km/h, 4.88 km/h and 4.98 km/h), working depth is 20 cm and working width is 90 cm. Researches were hosted by Agricultural Research and Development Station Podu-Iloaie, Iaşi County. From the presented dates it is obviously that the unit U-650+PRP-3 use a higher traction power force of the tractor at all working speeds and all types of soil face to the U-650+PP-3-30 ploughing unit due to the fact that PRP-3 plough is heavier that PP-3-30 one.*

Rezumat. *Prezenta lucrare are drept principal scop stabilirea puterii de tracțiune a tractorului utilizată de două agregate diferite de arat la efectuarea arăturilor superficiale. Cele două agregate sunt compuse din tractorul U-650 şi plugul normal PP-3-30 iar cel de al doilea din tractorul U-650 şi plugul reversibil PRP-3. Condițiile de lucru au fost următoarele: trei tipuri de sol cu rezistența diferită la arat (sol uşor, sol mediu şi sol greu), patru viteze diferite de lucru (4,48 km/h, 4,61 km/h, 4,88 km/h, 4,98 km/h), adâncimea de lucru a fost stabilită la 20 cm iar lățimea de lucru a fost reglată la valoarea de 90 cm. Cercetările s-au desfăşurat pe câmpurile experimentale ale Stațiunii de Cercetare-Dezvoltare Podu-Iloaie, județul Iaşi. Din datele prezentate este evident faptul că agregatul agricol de arat U-650+PRP-3 foloseşte mai mult din puterea dezvoltată de motor decât agregatul U-650+PP-3-30 pentru toate tipurile de sol şi la toate vitezele de lucru acest fapt datorându-se şi diferenței de greutate dintre cele două pluguri, în favoarea plugului PRP-3.*

In order to establish the most adequate types of ploughs, which will work in aggregate with the 65 HP tractors, research and experiments have been performed. The main research criteria consist, on one hand, of reaching the imposed agro-technical demands, and on the other hand, of presenting a rational usage of the energetic base.

Making the soil basic work, as tillage is known, is in a direct connection with the soil type, which from the point of view of agriculture mechanization has various characteristics, both due to different mechanic features and variations of humidity and soil compaction.

The present paper, aims at establishing the optimal type of plough, in order to be able to perform some superficial tillage, which will work in aggregate with the 65 HP tractor, within the current framework provided by the conditions of tending and use.

The research took into consideration the study of the types of ploughs used for superficial tillage (at a depth of 15-20 cm) in aggregate with 65 HP tractors.

MATERIAL AND METHOD

To establish the optimal type of plough used for superficial tillage were studied the following two ploughing units:

aggregate formed by U-650M tractor and PP-3-30 plough;

aggregate formed by U-650M tractor and PRP-3 reversible plough.

The experiences took place on three types of soil with different specific resistance at ploughing:

- a light soil with K_0 (specific resistance at ploughing) smaller than 0.35 daN/cm^2 (typical chernozem) (**variant 1**);
- a medium soil with K_0 (specific resistance at ploughing) between 0.35-0.55 daN/cm^2 (chernozem cambic mezocalcaric) (**variant 2**);
- a heavy soil with K_0 (specific resistance at ploughing) between 0.56-0.75 daN/cm^2 (luvosoil) (**variant 3**).

Working speeds, which were used during experiments, were from the IIH gear and had the following values: 4.48 km/h; 4.61 km/h; 4.88 km/h and 4.98 km/h.

The working depth was 20 cm and working width was 90 cm. Researches were hosted by Agricultural Research and Development Station Podu-Iloaie, Iaşi County.

RESULTS AND DISCUSSIONS

Are presented the obtained results of the tractors' traction power force for the four distinct working speeds, in the conditions of making tillage on those three types of soil, with the two above mentioned tillage aggregates (U-650M+PP-3-30 and U650-M+PRP-3) (tables 1, 2, 3 and 4).

Table 1

Tractors' traction power force function of soil type (V_1 = 4.48 km/h)

Working conditions	U-650M+PP-3-30			U-650M+PRP-3		
	Variant 1	Variant 2	Variant 3	Variant 1	Variant 2	Variant 3
Working speed (km/h)	4.48	4.48	4.48	4.48	4.48	4.48
Traction power force (HP)	21.90	23.39	24.40	24.72	25.13	25.88

From the dates presented in table and figure 1 should be remark the fact that tractors' traction power force increase together with the increasing of K_0 (specific resistance of ploughing). So the lowest values were recorded when

tillage work was done on a light soil, resulting 21.90 HP at usage of PP-3-30 plough, respectively 24.72 HP for PRP-3 reversible plough.

The maximum values were recorded at tillage on heavy soils recorded 24.40 HP when PP-3-30 plough was used, respectively 25.88 HP at using PRP-3 reversible plough.

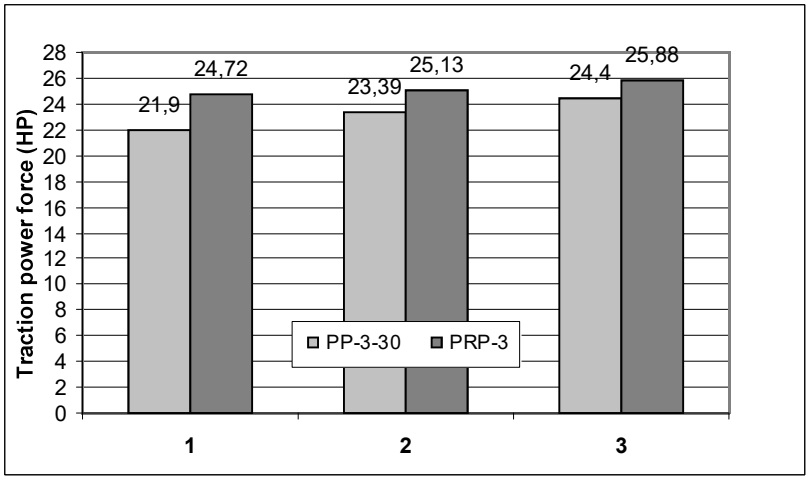

Fig. 1. Variation of tractors' traction power force function of soil type (V_1 = 4.48 km/h)

From the dates presented in table and figure 2 could be observed the fact that tractors' traction power force increase with the increasing of the specific resistance at ploughing (K_0) also in the case at making tillage with the working speed of 4.61 km/h.

Table 2

Tractors' traction power force function of soil type (V_2 = 4.61 km/h)

Working conditions	U-650M+PP-3-30			U-650M+PRP-3		
	Variant 1	Variant 2	Variant 3	Variant 1	Variant 2	Variant 3
Working speed (km/h)	4.61	4.61	4.61	4.61	4.61	4.61
Traction power force (HP)	22.11	23.52	24.26	24.80	25.42	26.07

The minimum values were obtained when tillage was processed on a light soil, recording 22.11 HP at using PP-3-30 plough, respectively 24.80 HP for using PRP-3 plough.

The maximal values were obtained at tillage on heavy soils recording values of 24.26 HP at using the aggregate formed by U-650+PP-3-30 respectively

26.07 HP when the tillage was carried out with the aggregate formed by U-650+PRP-3.

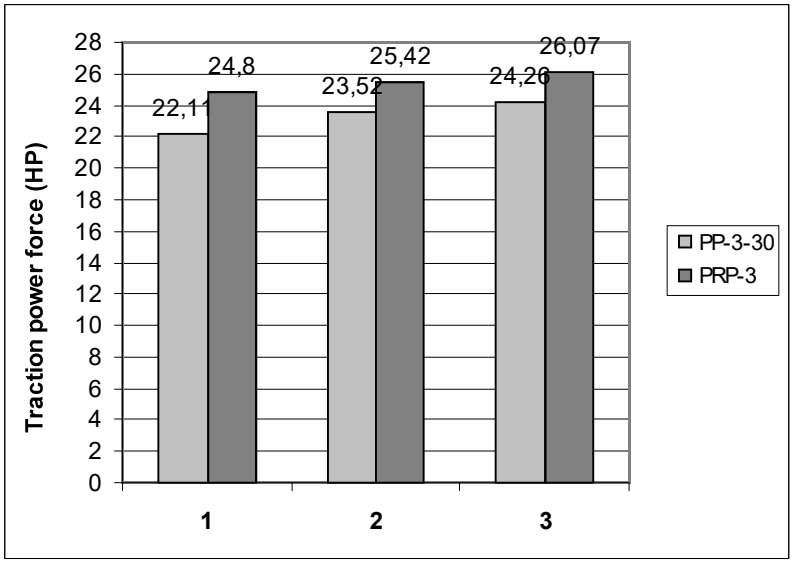

Fig. 2. Variation of tractors' traction power force function of soil type (V_2 = 4.61 km/h)

Tracking the dates presented in table and figure 3 could be remarked the fact that the tractors' traction power force increase at the same time with the increasing of specific resistance at ploughing (K_0) also in the case of tillage with 4.88 km/h as working speed.

So in this experiment the minimal values were recorded when tillage was done on a light soil, obtaining in this case 22.70 HP at using the PP-3-30 plough respectively 25.52 HP when PRP-3 reversible plough was used.

Table 3

Tractors' traction power force function of soil type (V_3 = 4.88 km/h)

Working conditions	U-650M+PP-3-30			U-650M+PRP-3		
	Variant A	Variant B	Variant C	Variant A	Variant B	Variant C
Working speed (km/h)	4.88	4.88	4.88	4.88	4.88	4.88
Traction power force (HP)	22.70	24.27	25.32	25.52	26.44	27.02

At tillage on heavy soils were recorded the following maximum values, 25.32 HP at usage of PP-3-30 plough respectively 27.02 when was used the reversible plough PRP-3.

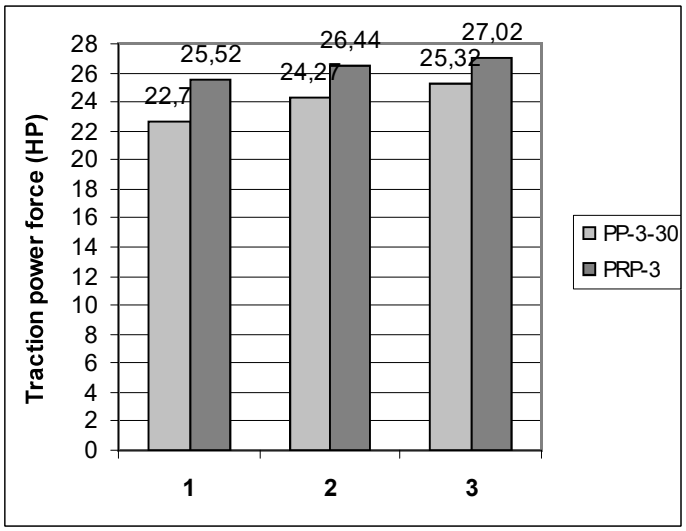

Fig. 3. Variation of tractors' traction power force function of soil type (V_3 = 4.88 km/h)

From the dates presented in table and figure 4 could be observed that tractors' traction power force increase together with the increasing of specific resistance at ploughing (K_0) also in the case of tillage with V_4=4.98 km/h as working speed.

The lowest values were realized, also, when tillage was processed on a light soil obtaining 22.68 HP at using the normal plough PP-3-30, respectively 25.82, for the reversible plough PRP-3.

Table 4

Tractors' traction power force function of soil type (V_4 = 4.98 km/h)

Working conditions	U-650M+PP-3-30			U-650M+PRP-3		
	Variant A	Variant B	Variant C	Variant A	Variant B	Variant C
Working speed (km/h)	4.98	4.98	4.98	4.98	4.98	4.98
Traction power force (HP)	22.68	24.43	25.67	25.82	26.61	27.31

The highest values were recorded at tillage on heavy soils, being recorded values of 25.67 HP at the usage of PP-3-30 plough and respectively 27.31 HP at using the reversible plough PRP-3.

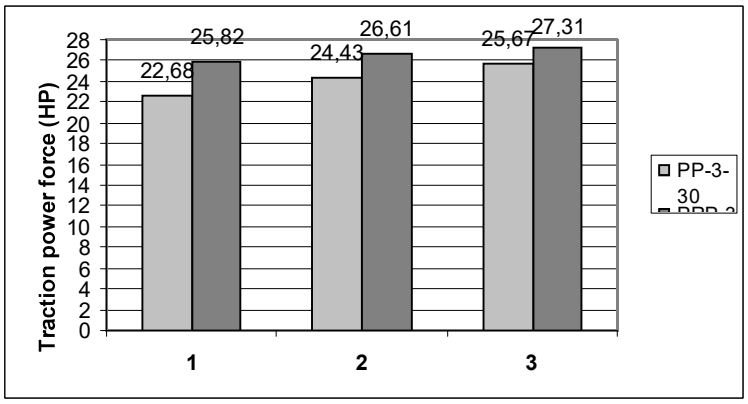

Fig. 4. Variation of tractors' traction power force function of soil type (V_4 = 4.98 km/h)

CONCLUSIONS

On the basis of the above presented results could be observed the fact that tractors' traction power force is influenced by the soil type where tillage is processed. So the minimal values of tractors' traction power force were recorded at tillage on light soils and the maximal ones were obtained in the conditions in which tillage was done on heavy soils. At the same time in which the ploughs' traction resistance increase , the real working speed decrease, fact which affect the fuel consumption and working capacity of the aggregate. Increasing the ploughs' traction resistance increase, at the same time, tractors' traction power force and could be observed the fact that working speed had a low influence on that power. Traction power force keeps between very close values for tillage on the same type of soil, with the same ploughing aggregate and with different working speeds.

So at superficial tillage with PP-3-30 plough, with the four working speeds (V_1=4.48 km/h; V_2=4.61 km/h; V_3=4.88km/h and V_4=4.98 km/h), tractors' traction power force had, for light soil, values between 21.90-22.68 HP; for medium soil, the values were between 23.39-24.43 HP and for heavy soil the values were between 24.26-25.67 HP.

At superficial tillage with reversible plough PRP-3, with the same four working speeds, tractors' traction power force had the following values: for light soil between 24.72-25.82 HP; for medium soil between 25.13-26.61 and for heavy soil the values were from 25.88 to 27.31 HP.

REFERENCES

1. Avarvarei B. V., 2007 – *Researches regarding the establishment of plough type for superficial and normal ploughinghs.* Doctorate thesis, University of Agricultural Sciences and Veterinary Medicine from Iaşi.