THE SEEDING PARAMETERS OF JOHN DEERE 1760 WING-FOLD DRAWN PLANTER AT DIFFERENT SPEED

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ABSTRACT
Sowing is a key element of agricultural technology, since this operation is of crucial importance for the future development of plants. Sowing seeds evenly, at about the same distance, at the right time provides even germination and uniform crop which finally results in a better quality and higher yields.
Out of the planters those are the maize-planting machines that represent the largest share, the ones that are able to sow not only maize but also other plants (e.g. sunflower) can also be planted in proper quality.
The sowing parameters of the John Deere 1760 wing-fold drawn planter were examined at Hód-Mezőgazda Zrt. in Hódmezővásárhely.
The sowing parameters of maize were analyzed from two aspects. First, we examined if the seeding rate influences the plant spacing per row and planting depth. On the other hand, how the method of the soil preparation affects the sowing parameters at the same speed of sowing.

Keywords: sowing, John Deere1760 planter, sowing seed, soil preparation, maize

INTRODUCTION

Sowing is a key element of agricultural technology, since this operation is of crucial importance for the future development of plants. Sowing seeds evenly, at about the same distance, at the right time provides even germination and uniform crop which finally results in a better quality and higher yields.
SOÓS and FŰZY (2006) say: „the quality of sowing directly influences germination, the uniformity of the crop, the development of plants and through that the quality and quantity of the yield."
The operation, agro-technical and technical requirements of the planting machines used in the fields are defined in the National Standard MSZ 19104/1-79.
The most important requirements are the following (SÍPOS, 2004):

- The machine must not break the seed; the value of the broken seed should not exceed 1-2%.
- The rate of sown seed over a wide range can be quickly changed.
- The sowing must be independent of the amount of seeds in the seed-box.
- The digression of the amount of sown seeds on plains can be ±3%, while on slopes ±10%.
- The amount of the sown seed by each coulter can be different from the mean by ±5%.
- 90% of the sown seeds must be in the set depth of sowing ±1 cm.
- It is a general requirement for the seeders that more than 80% of the cells of the sowing structure sow without twin-sowing and the ratio of the empty cells should be under 6%.
- The horizontal or vertical bend of the machine must not have a harmful influence on the rate of sowing.

The sowing machines are built by two main systems, regarding the grabbing and forwarding the seeds, therefore they can be pneumatic or mechanical.
The advantages of mechanical machines are the accurate sowing (98-99%), the quick plant

distance adjustment, the low weight of the machine and in relation to that is the relatively low price of the machine. Their disadvantage is the low advancing speed (5–7 km/h) therefore they have lower area-performance than the pneumatic sowing machines.
The disadvantages of the pneumatic machines are the higher weight and power demand, the more complicated structure, and also the lubberly plant distance adjustment. It is not as correct and punctual as the mechanical machines, although it works at a higher speed, and this is why it has a higher area-performance (HAJDÚ, 2012).
Out of the planters those are the maize-planting machines that represent the largest share, the ones that are able to sow not only maize but also other plants (e.g. sunflower) can also be planted in proper quality (FŰZY, 2008; FŰZY and MÉSZÁROS, 2005). By the seed-by-seed sowing, our purpose is that the machine puts the seeds in even rows at the same distance in the same depth in the wet, compact bottom of furrow opened up by the coulters and then also covers them with a layer of soil adequate for germination.
The sowing parameters of the John Deere 1760 wing-fold drawn planter were examined from two aspects. First, we examined if the seeding rate influences the plant spacing per row and planting depth. On the other hand, how the method of the soil preparation affects the sowing parameters at the same speed of sowing.

MATERIAL AND METHOD

The research was carried out in the fields of Hód-Mezőgazda Zrt, Hódmezővásárhely, where the sowing took place in seed beds prepared for sowing in two different ways. One of the fields was prepared with the traditional technology (disking, ploughing, seedbed preparation) *(Figure 2.)*, while the other field was prepared without turning the soil (ripping technology, disking, seedbed preparation) (*Figure 1.*) for preparing maize sowing.

Figure 1. Ripping technology soil preparation

Figure 2. Plough technology soil preparation

The seedbed was suitable for sowing, porous, crumbled consistency, however there was a lack of precipitation in the period before sowing. It could be due to the low level of humidity in the soil or sometimes the uneven soil that the seed did not always get into wet soil.
The experiment of the sowing parameters of the John Deere 1760 wing fold planter was carried out between 3 and 11 April, 2012.
During the experiment 193 hectares were sown with maize for silage. At the time of sowing the parameters of the machine were the following: row distance 76 cm, spacing

18.73 cm, sowing depth 7 cm and seed number per hectare 69,327.
During the examination of the operating machine at 8 km/h, 11.1 km/h and 12 km/h work speed we examined the maize spacing, seed number on an area unit and the sowing depth and comparing the two types of soil preparations we observed the same sowing parameters. To determine the sowing parameters we examined 1,31 m long sowing lines with 76 cm row distance which meant 1 m^2 experiment area units. The examinations were carried out in 5-5 repetitions. The obtained data were analysed and assessed with SPSS 18 statistical programme (SAJTOS 2007).

RESULTS

The mean and standard deviation of the spacing measured at various speeds are illustrated in *Table 1*.

Table 1. Spacing in maize sown at different speeds in soils prepared with ripping

	Speed (km/h)	Planting distance (cm)							
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Ripping technologhy	8.0	31	19.21	6.99	1.26	16.65	21.77	12	45
	11.1	32	19.38	7.71	1.36	16.60	22.15	10	50
	12.0	32	18.58	7.60	1.34	15.84	21.32	10	51
	Total	95	19.05	7.37	0.76	17.55	20.55	10	51

The single-factor analysis of variance indicated that the differences between spacing measured at various speeds are not significant, i.e. the speed does not affect the spacing ($p<0.05$).
When we examined the spacing in case of two different soil preparation methods at the same speed (11.1 km/h) we found that the mode of soil preparation did not cause significant difference (*Table 2*).

Table 2. Spacing in maize sowing in case of different soil preparations

	Speed (km/h)	Planting distance (cm)							
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Ripping	11.1	32	19.38	7.71	1.36	16.60	22.15	10	50
Plough	11.1	32	18.30	4.84	0.85	16.55	20.04	14	34

Table 3. Seed number in maize sowing

	Speed (km/h)	Number of seeds sown (db/ha)			Percentage deviation from the instructions manual setting (69327 db/ha)
		Mean	Lower Bound	Upper Bound	
Ripping	8.0	69 409	61 236	80 101	0.1
	11.1	68 817	60 182	80 345	-0.7
	12.0	71 769	62 543	84 188	3.5
Plough	11.1	72 872	66 532	80 547	5.1
Total		70 688	66 471	75 476	2.0

When examining the number of the sown seeds per hectare (*Table 3*), it can be concluded that the deviation from the factory settings in case of ripped soils was around the value of the standard. In case of the soil prepared with traditional technology the value was 5.1%, which is higher than described in the standard.

When examining the sowing depth of maize (*Tables 4-5*, *Figure 3*) it can be observed that the difference between sowing depths at different speeds in soils prepared by the same way was significant.

The table shows that the sowing depth at 8 km/h speed was significantly different from those determined at sowings carried out at 11.1 km/h and 12 km/h ($p<0,05$).

Table 4. Sowing depth of maize at different speeds in ripped soils

	Speed (km/h)	Sowing depth (cm)							
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Ripping technologhy	8.0	36	6.96	0.45	0.08	6.80	7.11	5.9	8.1
	11.1	37	7.13	0.22	0.04	7.06	7.21	6.8	7.8
	12.0	37	7.16	0.28	0.05	7.07	7.25	6.7	8.1
	Total	110	7.08	0.34	0.03	7.02	7.15	5.9	8.1

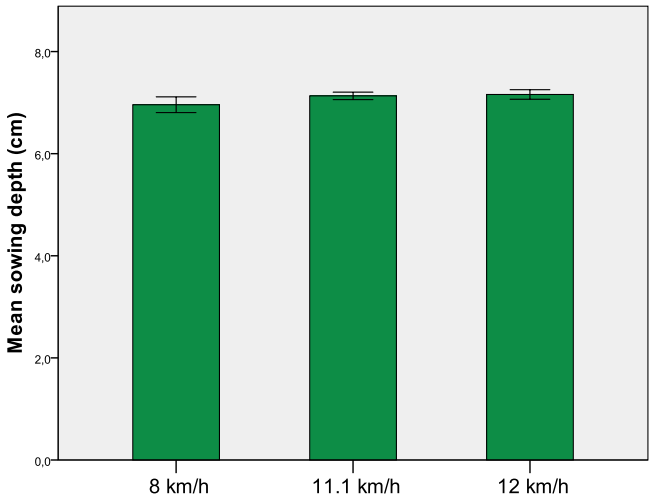

Figure 3. Average sowing depth of maize in ripped soils

Table 5. The LSD test of the sowing depth of maize in ripped soils

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
8.0 km/h	11.1 km/h	-0.1741*	0.0777	0.027	-0.328	-0.020
	12.0 km/h	-0.2011*	0.0777	0.011	-0.355	-0.047
11.1 km/h	8.0 km/h	0.1741*	0.0777	0.027	0.020	0.328
	12.0 km/h	-0.0270	0.0772	0.727	-0.180	0.126
12.0 km/h	8.0 km/h	0.2011*	0.0777	0.011	0.047	0.355
	11.1 km/h	0.0270	0.0772	0.727	-0.126	0.180

*. The mean difference is significant at the 0.05 level.

When examining the sowing depth of maize in soils prepared with different methods (*Figure 4*) we can say by the figures that there is no significant difference between the sowing depths.

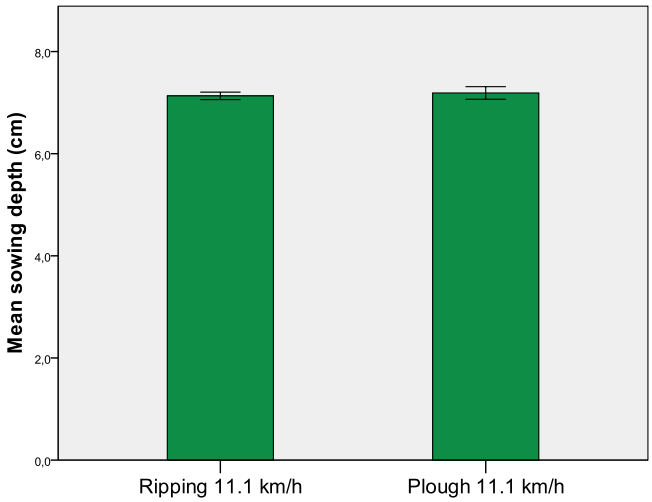

Figure 4. The sowing depth of maize in soils prepared with different methods

After the application of the statistical method used so far it can be found that the sowing speed influences the sowing depth of maize significantly. while the method of soil preparation does not.

CONCLUSIONS

After the statistical analysis we can conclude that spacing in maize sowing was influenced neither by the method of soil preparation nor the speed of sowing. therefore it is advisable to carry out sowing at higher speed and then the area performance is increasing as well.
When examining the accuracy of the machine it can be concluded that the deviation from the factory settings in sown seed number was below 5.1%.
When examining the sowing depth of maize different speeds resulted in deviation. therefore it is advisable to choose the correct speed to achieve the prescribed sowing depth; here also a higher speed is advisable.
Based on the field examinations we can conclude that the John Deere 1760 12 wing-fold planter can be well used for maize sowing. however attention must be paid to choosing the correct speed. It is a wide-spread planter even today. because of its high area-performance. John Deere did not make major changes in the seed dispensing structure in their planters developed lately. only the driveline was modernised and expanded with ISOBUS system for the row control.

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