

EFFICIENCY OF THE SEEDING INTEGRATED POWER UNIT AT MAIZE PRODUCTION ON FAMILY FARMS

R. Zimmer, M. Jurišić and J. Kanisek

Abstract: *Efficiency investigation of the seeding integrated power unit at mercantile maize production was carried out on production areas of a family farm near Donji Miholjac in Eastern Croatia during the 2001. The experiment was set up on a deep alluvial carbonate sandy-sandy loamy (plot A) and loessive arable land (plot B) of the total area of the 7.5 ha⁻¹. The A plot (dimension 300x180 m) contained 1.34% of humus and pH=5.37. Two seeding variants were set up: maize seeding by the integrated power unit Cyclotiller RAU (Germany)+pneumatic seeding machine PSK OLT after basic tillage (a plough) and conventional additional soil tillage (a disc harrow, harrow, seed bed preparation implement) on the B plot. The seeding was carried out on 4 May whereas the hybrid Bc 5982 was sown in a row 22.5 cm apart and the rows 70 cm apart on both plots.*

Prior to the seeding the A plot was fertilized with 150 kg ha⁻¹ of UREA whereas two tillages and two top dressings with KAN at a dose of 100 kg ha⁻¹ i.e. total of 200 kg ha⁻¹ were done during the growing season. Plant protection was carried out by the Radazin 2 l ha⁻¹ + Gardian 1 l ha⁻¹. The determined stand was 59.533 plants ha⁻¹. The B plot was fertilized with NPK 15:15:15 kg ha⁻¹ by a stripe cropping whereas tillage, top dressing and protection were accomplished as on the A plot by adding Motivel 1 l ha⁻¹. The determined stand was 58.600 maize plants per hectare.

The A plot maize yield amounted 6.769 kg ha⁻¹ after having done harvesting (7 and 23 october 2001), weighing and recomputation to 14 % of moisture. Higher B plot maize yield was characterized by somewhat more abundant and qualitative fertilization performance, the production on the soil with considerable pH value (5.37% on B plot and 3.86 % on the A plot), higher consumption of human labour and machinery work as well as more numerous passes of the agricultural machines until the sowing.

Key words: Integrated sowing power unit, maize, Family farms

INTRODUCTION

Maize is the most dominant crop on the family farm fields of eastern Croatia. The production is based on the conventional technology application where soil is cultivated by a plough followed by 4-8 operations of additional cultivation and separated sowing. No doubt, it is the most expensive soil tillage fashion being dominant not only in eastern Croatia but in 85% of EU production areas (Stroppel, 1997). This method is characterized by some modifications intended for reduction of energy consumption as well as human and machine work. The modifications refer to operations connection by assembling univalent machines into a so called integrated power unit. In this case we are talking about reduced tillage.

An integrated power unit consisting of Cyclotiller RAU (roto harrow) and domestic pneumatic sowing machine PSK OLT have been used in our country at maize production for more than a decade. Additional tillage and one pass sowing is conducted very efficiently on pre-ploughed soil. However, although sowing integrated power units have been used more recently on family farms at other crops production, there are still no exact data about it.

This paper deals with annual results of the investigation concerning sowing integrated power unit at maize production on a family farm.

MATERIAL AND METHODS

A year investigation concerning efficiency of the sowing integrated power unit Cyclotiller RAU + PSK-4 at maize production in 2001 was carried out on the family farm close to D. Miholjac. An experimental field consisted of A plot (dimension 300 x 150 m), and B plot (dimension 200 x 150 m).

Plot A ploughing was conducted by a three furrow reversible plough 25-30 cm deep in November 2000 whereas urea fertilization with 150 kg ha⁻¹ preceded sowing. On 4 May 2001 sowing of the hybrid BC 5982 was carried out in an interrow space of 70

cm and grain in a row of 22.5 cm in one pass by the integrated power unit Cyclotiller RAU + PSK-4. Top dressing was done with 100 kg ha⁻¹ KAN at first cultivation and with the same dose at the second one. Crop protection was conducted with Radazin (2 l ha⁻¹ + Gardian (1 l ha⁻¹).

Basic soil tillage of both A and B plot has been done in the same fashion. In March 2001 an additional soil tillage was carried out by two passes of a disk harrow as well as harrow and seed bed preparation implement. The same hybrid sowing was performed at the same interrow space and row grain interspace by the sowing machine PSK-4. Strip fertilization with 190 kg ha⁻¹ NPK 15:15:15 was carried out followed by sowing (4 May). One cultivation and crop top dressing by using 100 kg ha⁻¹ KAN were also conducted. Crop protection is similar to the A plot protection with addition of Motivel 1 l ha⁻¹.

Soil samples for determination of phosphorus, potassium and humus content were taken on the very day of sowing and analyzed at the Department of Agrochemistry of the Faculty of Agriculture Osijek. Soil respond in H₂O and 1MKCL was determined electrometrically. AL level of the available P₂O₅ and K₂O was determined according to Egner, Riehm, Domingo by using molibdan-vanadat procedure for phosphorus and emission measuring of potassium for AAS at 766.5 nm (Vukadinović and Bertić, 1988). Humus level was measured by the bicromate method (Vukadinović and Bertić, 1988).

Weather conditions for the investigated period was recorded by the Weather Department in Osijek from April to October 2001.

Moisture of the harvested maize and yield was determined in the laboratory, i.e. at the automatic scale «Žitar» D. Miholjac.

RESULTS AND DISCUSSION

Results of agrochemical analysis of the soil used for investigation of the sowing integrated power unit efficiency, conventional additional soil tillage and separated sowing at maize production were on the A plot (alluvial carbonate sand-sandy loamy) and B plot (loessive arable land) as follows:

Table 1. Agrochemical soil analysis

Plot	pH		Al-extraction Mg/100 g tla		Humus %
	H ₂ O	KCl	P ₂ O ₅	K ₂ O	
A	5,45	3,86	10,8	13,54	1,34
B	5,98	5,37	17,12	13,36	1,48

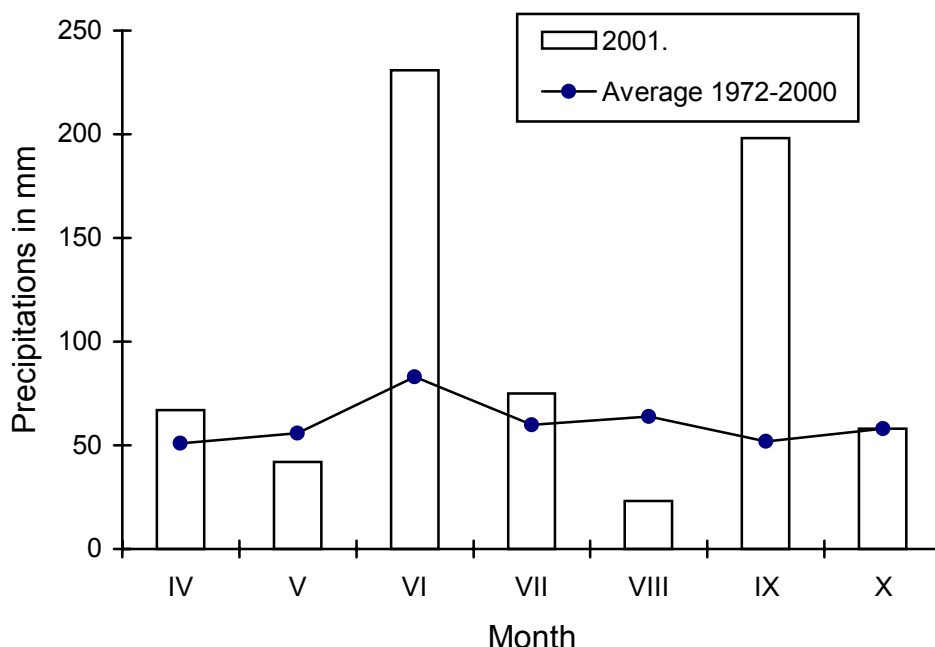
The A plot is a soil of very acid respond whereas B plot is of acid respond. According to the soil humus content both plots belong to the group poor in humus (Škorić, 1982). On the basis of the limit values for eastern Croatia area (Vukadinović and Lončarić, 1998) Al supply of the available P₂O₅ is poor on the A plot and good on B one. Al supply from the available K₂O is poor on both plots.

Distribution of precipitations during the maize growing season from April to October 2001 is presented by the Figure 1.

Precipitations distribution in the maize growing season was not very favourable since there were only 42 mm in May and especially in August (23 mm) being less compared to many years' average (56 mm and 64). In June (231 mm) there was almost double and in September (198 mm) four-ply more precipitations compared to many years' average for these months (83 mm and 52 mm).

Unusually large amounts of precipitations in September were not welcome prior to this crop harvest in October known for average values.

Figure 1. Distribution of precipitations per months of the 2001 compared to many years' average (Agrometeorological station Osijek)



Average maize stand of 59.533 plants ha⁻¹ on the A plot and 58 600 plants ha⁻¹ on the B plot was determined on 8 June. Maize yield containing 14% of moisture was calculated after its harvesting on 7 October on the A plot and 23 October on the B one.

Table 2. Natural yield and maize yield computed by the warehouse balance

Plot	Natural yield		Yield containing 14% water
	Kg ha ⁻¹	Moisture %	
A	8.285	32,3	6.769
B	8.163	23,1	7.420

Basic soil tillage conducted on the A plot by a three-furrow reversible plough at 25-30 cm depth in November 2000 was followed by transporting and distributing mineral fertilizer (150 kg ha⁻¹ UREA) in April 2001. On 4 May maize sowing was carried out by an integrated seeding power unit Cyclotiller RAU+PSK-4. B plot basic soil tillage was accomplished as well as on A plot followed by additional soil tillage with two disk furrow passes, one disk furrow pass and one seed bed preparation implement. A sowing was carried out by PSK-4 sowing machine with simultaneous fertilization in strips using 190 kg ha⁻¹ NPK 15:15:15. Machinery effect and machine work hours consumption for 7 working hours during the working operations finished with sowing on both plots can be presented by the table below:

Only 4 machine passes (plough, fertilizer transport, fertilizer distribution, sowing by an integrated sowing power unit) and 4.12 machinery working hours are required for the maize sowing on A plot. Total of 7 machine passes (plough, fertilizer transport, 2x disk harrow, harrow, seed bed preparation implement, sowing by a sowing machine PSK-4) and 7.31 machinery working hours is needed for B plot.

Table 3. Machines effect and machinery working hours consumption for seven working hours

Num.	Plot A			No	Plot B		
	Operation	Effect (ha)	Mach. Working hours consup. for 7 w. h.		Operation	Effect (ha)	Mach. Working hours consup. for 7 w. h.
1.	Ploughing	3,1	2,26	1.	Ploughing	3,1	2,26
2.	Take out of fert.	80,0	0,09	2.	Take out of fert.	80,0	0,09
3.	Fertilization	21,7	0,32	3.	Disking I	6,3	1,11
4.	Sowing Cyclotiller+PSK-4	4,7	1,45	4.	Disking II	7,0	1,00
				5.	Harrowing	10,0	0,70
				6.	Seed bed prep.	9,3	0,75
				7.	Sowing PSK-4	5,0	1,40
Total			4,12				7,31

CONCLUSION

After the results have been obtained the conclusions can be drawn as follows:

-The investigation has been conducted on a family farm with substrate low in humus and main nutrients supply , especially phosphorus on A plot.

-Precipitation rate meets the requirements in the maize growing season but not the distribution. There was little rain in the pre-tasseling and tasseling phase and grain formation period, especially in August.

-Four passes and 4.96 working hours of machines are required for additional soil tillage and separate sowing on B plot whereas only one pass is demanded provided sowing integrated power unit (Cyclotiller RAU + PSK-4) is used since it performs additional soil tillage and sowing in one pass.

-Higher maize yield on B plot is characterized by somewhat richer and more qualitative performed fertilization as well as production on the soil with higher pH value (5.37% on B plot unlike 3.86% on A plot).

-Four passes and 4.12 machinery working hours are required for maize sowing (after basic tillage and fertilization) on B plot whereas 7 passes and 7.31 machinery working hours are required on B plot (after basic tillage, fertilization and additional tillage) making this method more expensive.

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