RESEARCH ON THE INFLUENCE OF SOIL WORKS ON COWPEA CULTIVATED UNDER ECOPEDOLOGICAL CONDITIONS IN SOUTHERN OLTENIA

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ABSTRACT

The results obtained in the cowpea culture, studied during 2016-2018 in the conditions of the sandy soils, highlight the importance of germination bed preparation and the size of the nutrition space on the growth and fructification processes of the plant. Analyzing the soil moisture dynamics during the plant vegetation, there is a better conservation of water in the soil, when was performed by plowing at a depth of 22-25 cm + disking to a depth of 10-15 cm, the soil moisture being within the limits of 6.98-16.8%. The best results were recorded by sowing 25 germinable seeds / m^2 in a germination bed prepared by the plowing at a depth of 22-25 cm + disking of 10-15 cm deep (9.75 pods / plant, 8.85 grains / pod, 2483.5 kg / ha). This version was recorded the lowest level of weed (scoring on the EWRS scale with note 2.0, in the branching phase and 1.66, in the flowering phase

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INTRODUCTION

The cowpea (Vigna unguiculata (L.) Walp), is a leguminous plant of vital importance to millions of people in West and Central Africa. It provides a less expensive source of protein for both rural and urban consumers (Inaizumi et al., 1999, Kamara et al., 2018). The development of research on the cultivation of cowpea on sandy soils in southern Oltenia has led to the need to increase agricultural yields on land with low natural fertility, from the category of sandy soils, where the legume culture for grain often involves serious risks, as a result of the action limitation of numerous restrictive specific factors. Research on the effect of the soil works highlights their impact on the accumulation and preservation in the soil of a larger amount water from rainfall, the accumulation of as much nutrients, as possible in the soil by stimulating nitrification processes, creating favorable conditions for germination of seeds and providing a crop with as less weed (Lupu, 2009, Ball et al, 1999). The problem of the plant density, the relationship of the soil – climate - agrotechnics (for example, soil working) occupies a much greater as to ensure an optimum number of plants per unit of area is the basis to obtain an increased production with additional costs minimum (Sipos Gh. Et al., 1981, Kamara et al, 2018). The results presented in the literature, highlight the close link between production and the space of the cowpea plant (Drăghici Reta, 2012, Robertson B.M., 1985, Dadson, R.B., 2005). The competition between plants for solar energy, water and nutrients accessible to neighboring plants, which is particularly evident during the development of the foliar system and the root system, is of great importance for the sandy soil area. On these lands, the plants must ensure that the surface is shaded to the highest degree in order to protect the overheating sand and, at the same time, the space for a plant to provide water and mineral

substances in sufficient quantities for good development (Zăvoi A., 1967).

MATERIAL AND METHOD

The researches were carried out during the period 2016-2018, under ecopedological conditions in southern Oltenia, and they focused on the influence of soil works and plant density over the production of the cowpea. The experiment was placed in the field, according to the parcel method subdivided by two factors: Factor A - Soil works (Scarified to a depth of 55-60 cm; Plowing at a depth of 22-25 cm + Disking of 10-15 cm deep; Disking at a depth of 10-15 cm); Factor B - sowing density with three graduations (20 seeds germinable / square meter, 25 seeds germinable / square meter, 30 seeds germinable / square meter). The research was carried out on the Doljana cowpea variety, sown under irrigation conditions on a sandy soil with reduced natural fertility. At the beginning of the experiment, were made laboratory tests on the physical and chemical quality of the soil. Determinations were performed on the soil moisture of 30 to 30 days, the degree of weed, determinations and measurements and determinations of biometrics and productivity of the plant. The obtained results were statistically interpreted by the analysis of the variant and using the mathematical functions.

RESULTS AND DISCUSSIONS

Results on soil chemical properties, highlight differentiated values on the soil profile (Table 1). Thus, the pH values migrated from a weak acid to a depth of 0-50 cm, to neutral on a depth of 50-75 cm. The humus content recorded overhead values on a depth of 0-25 cm and due to the richer organic material resulting from the spreading of the deposits resulting from the draining of the drainage channels, the experiment being located along such a drainage channel. On the profile of the soil was recorded a low content in total nitrogen, with values between 0.03-0.06%, medium in phosphorus 18-38 ppm, as well as a good state of supply with potassium 40-83 ppm

Table 1

The chemical properties of psamosol within the experimental field

Depth (cm)	*pH (H2O))*	*Humus (%)*	*Nt (%)*	*P AL (ppm)*	*K AL (ppm)*
0-25	5.65	1.06	0.06	38	83
25-50	5.88	0.94	0.04	36	74
50-75	6.45	0.35	0.03	18	40

Analyzing the granulometric composition of psamosol in the experimental device (Table 2), there is a low content of clay (0.05 - 1.9%), dust (2-2.6%). In contrast, fine sand content increased to 21.6-24.4%, and coarse sand predominantly ranged from 72.4-75.9%.

During season of the cowpea growing (May-August), the amount of rainfall recorded 369.6 mm, which in conjunction with an average air temperature of about 20.68 ^{0}C, allowed a good growth and development of the cowpea plant (Table 3). Analyzing the soil moisture in dynamics during vegetation of the plant, there is a better conservation of the soil water in the version Plowing at the depth of 22-25 cm + Disking to a depth of 10-15 cm, the soil moisture is in the interval 6,98 to 16.8%. There is a positive

correlation between soil moisture and accumulated monthly rainfall.

Table 2

The granulometric composition of psamosol within the experimental field

Depth (cm)	*Clay*		*Dust 0.002-0.02 mm*	Fine sand *0.02-0.2 mm*	Coarse sand *0.2-2 mm*
	< 0.02 mm	*< 0.01 mm*			
0-25	0.05	1.6	2.7	24.4	72.4
25-50	0.05	1.9	2.6	24.2	72.7
50-75	0.05	1.9	2	21.6	75.9

Table 3

Determination of soil moisture evolution during the vegetation period of the cowpea, depending on the soil and climatic conditions of 2017

Experimental variant	Depth (cm)	*Soil moisture (%) / climate conditions					Average soil moisture (%) / average air temperature (^{o}C)	The amount of rainfall from May to August (mm)
		April	May	June	July	August		
Scarified	0-25	13.74	15.93	5.49	15.98	5.87	11.40	
	25-50	13.78	14.75	6.04	14.78	6.44	10.96	
	50-75	12.97	14.45	6.88	14.36	6.12	10.96	
Average		13,5	15.04	6.14	15.04	6.144	11.11	
Plowing+ Disking	0-25	15.02	16.44	7.22	16.78	6.78	12.45	
	25-50	15.54	15.27	7.45	17.02	7.26	12.51	
	50-75	14.12	14.62	7.02	16.58	6.88	11.84	
Average		14,90	15.44	7.23	16.80	6.98	12.27	
Disking	0-25	13.22	13.68	5.42	15.02	4.38	10.34	
	25-50	13.68	13.75	5.96	14.21	5.02	10.52	
	50-75	13.11	12.64	4.77	12.77	4.16	9.49	
Average		13,33	13.36	5.38	14	4.52	10.12	
Climate conditions	Rainfall (mm)	62.8	78.6	17.4	120.8	28.8	x	369.6
	Average monthly air temperature (^{0}C)	12	17.8	24	24.8	24.8	20.68	x

*** Soil samples were collected at the end of each month**

The height of the plant, the height of insertion of the first pods / plant was influenced by the sowing density, these elements generally registering higher values in the variants at which higher densities were provided, thus reducing the nutrition space , which forced vegetative growth at the expense of productive growth (Table 4). Analyzing, however, the interaction of the two factors studied, cowpea best valorizes the density of 25 germinating seeds / square meter, when the preparation of the field was carried out through the Plowing at the depth of 22-25 cm + Disking at a depth of 10-15 cm (height of insertion of the first pod = 28.5 cm, the number of

pods / plant = 9.75, the number of seeds in the pods = 8.85).

The preparatory work the soil for sowing and plant density of the cowpea influenced the degree of weed culture, significantly (r = 0.677 *) and distinct significantly (r = 0.838 **) according to the stage of plant growth (Figure 1). Thus, in the branching phase was recorded a degree of weed, în EWRS scale, note in the range from 2 to 6.33, and the flowering stage, it fell within the limits of 1.33 to 4.3, the foliar defense of the plant suffocating much of the weeds. The lowest degree of weeds was recorded in the variants where the soil preparation was performed by plowing + disking. Similar research was conducted from maize by C. Lupu, 2009, which emphasized the importance of carrying out plowing, compared to only work scarified or disking.

Table 4

Biometrics and productivity results of the cowpea plant recorded under the influence of soil works and sowing density

Experimental variant	No. germinable seeds / square meter (g.s. / s.m.)	The height of the plant ***(cm)***	Minimum height of pods / plant insertion ***(cm)***	No.pods / the plant	No. seeds/ pod
Scarified	20	105.5	23	7.5	8,15
	25	116	22	7.25	7,5
	30	117.5	24	6.75	7,5
Average		113	23	7.17	7.72
Plowing + Disking	20	112.35	25.6	9.8	8,5
	25	118.9	28.5	9.75	8,85
	30	124.25	26.75	8.2	7,9
Average		118,5	26.95	9.15	8.42
Disking	20	108.5	25.35	9	8,75
	25	114	24.1	8	8,5
	30	118.5	25	6.5	7,65
Average		113,67	24.82	7.83	8.3

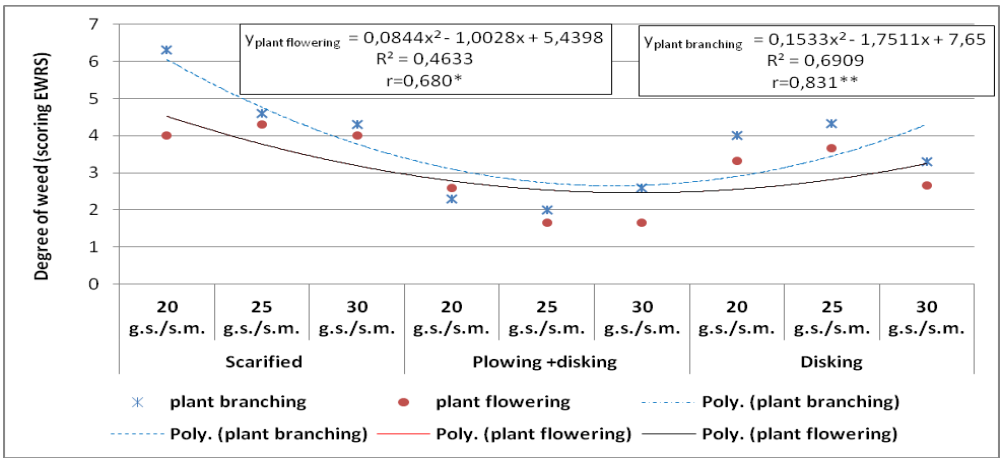

Figure 1. Correlation between the technological factor (soil working x density) and the weed degree of cowpea crop

Statistical analysis of the production of cowpea in different variants of the soil work and sowing densities, highlights the achievement of production differences of 294.5-543.5 kg / ha, in the soil work variant by plowing to the depth of 22-25 cm + disking to the depth of 10-15 cm, statistically assured as compared to sowing 20 g.s. / s.m., in scarified to the depth of 55-60 cm (Table 5). Under the study conditions, the cowpea plant best used the density of 25 g.s. / s.m., when the seed was made in a germination bed, prepared by plowing + disking (2483.5 kg / ha). The effect of the soil works on the cowpea yields is shown graphically in Figure 2, showing the variant of soil working by plowing at the depth of 22-25 cm + disking at 10-15 cm, by the difference of 478.67 kg / ha, compared to the scarified work at 55-60 cm deep and 176.5 kg / ha, compared to the soil disking at 10-15 cm deep.

Table 5

The influence of soil works and plant density on the production of beans obtained in cowpea under the conditions of sandy soils

Experimental variant	No. germinable seeds / square meter (g.s./s.m.)	Grain yield			Significance
		kg/ha	%	The difference compared to the control kg/ha	
Scarified	20	1940	100	Control	Control
	25	1998.5	103	58.5	
	30	1757	91	-183	
Plowing + Disking	20	2314	119	374	**
	25	2483.5	128	543.5	***
	30	2234.5	115	294.5	*
Disking	20	2137	110	197	
	25	2291	118	351	*
	30	2074.5	107	134.5	

LSD 5% = 263 kg/ha; LSD 1% = 370 kg/ha; LSD 0,1% =522 kg./ha

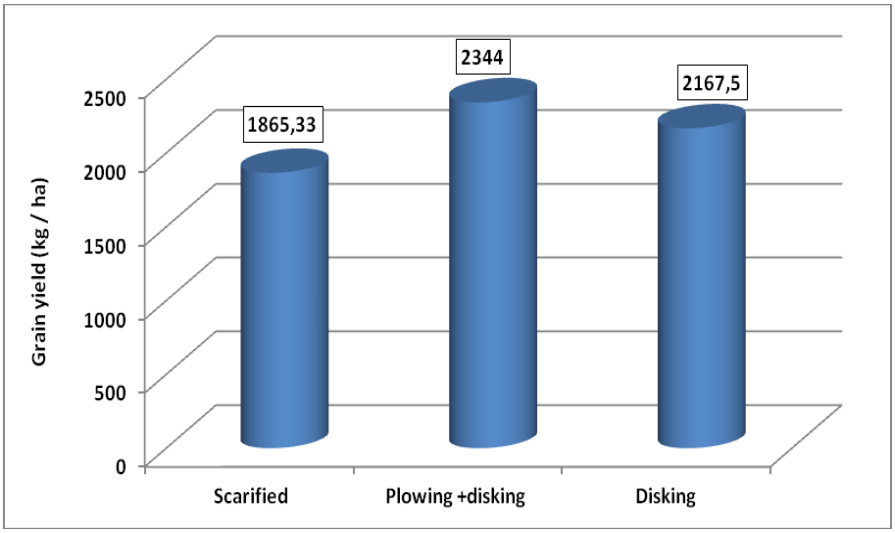

Figure 2. Production results obtained in cowpea under the influence of soil works

CONCLUSION

Preparing the germinative bed, by working at depths of 22-25 cm + disking at a depth of 10-15 cm, ensures the best soil moisture conservation during the vegetation period of the cowpea culture.

Working the soil and seeding density influenced the level of weed in cowpea culture, significantly (r = 0.677 *) and distinct significantly (r = 0.838 **), depending on the plant phase of the plant.

The cowpea has achieved the best results were recorded by sowing 25 germinable seeds / m^2 in a germination bed prepared by the plowing at a depth of 22-25 cm + disking of 10-15 cm deep (9.75 pods / plant, 8.85 grains / pod, 2483.5 kg / ha).

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