

THE STUDY OF SOME CULTIVARS OF COWPEA UNDER CLIMATE CHANGE IN SOUTHERN OLTENIA

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Abstract

The research was conducted during 2012-2015 in Research - Development Center for Agricultural Plants on Sands Dabuleni, and were aimed the study of 16 cultivars of cowpea in a comparative culture of competition, in order to introduce culture of the most valuable. In sandy soil conditions, the cultivars of cowpea registered a vegetation period in 92-109 days, requiring approximately 1997.2 to 2499.9°C, for maturing. The earliest varieties were: Aura 26, Aura, D4-1, Ofelia, and most late were Jiana, D12 / 2000 cowpea cultivars. The results concerning the productivity elements made from cowpea, indicate values differentiated by cultivar. They were marked by high levels of productivity elements, Aura 26, Ofelia, D2-b / 93, Aura, D2-3a, D3-5 cultivars, which recorded over 11 pods / plant and over 10 grains / pod. Between leaf area index (L.A.I.) and grain yield obtained at cultivars of cowpea, there is a distinct significantly negative correlation. The cultivars of cowpea, which have developed a value of L.A.I. by 5 to 5.4, were recorded the highest grain yields of 2603.7 to 2857 kg/ha (Ofelia, Aura, Aura 26, D2-3a, D3 / 93). Analysis on grain quality by cowpea cultivars, studied in sandy soils conditions, reflects an average protein by 22.4%, with values within limits from 20.5 to 23.8% and fats content with an average of 2.5%, which varied depending on the cultivar, between 1.9 to 2.9%.

Key words: drought resistance, foliar index, productivity, quality.

INTRODUCTION

Food safety is based, among other, and ensuring the genetic progress in agriculture, which is based on the evaluation of existing germplasm resources and from their specificity for a particular area (Draghici, 1999, 2003; Demooy, 1989). Originally from Central Africa, cowpea (*Vigna unguiculata* L. Walp), by biological characteristics of the plant, concerning increased resistance to drought and reduced requirements compared to soil fertility, can be a good alternative plant for bean and soybean, crop plants very sensitive to stress factors in areas with excessive drought (Marinica, 1994; Sinclair et. al., 2015). As a result of the high content of protein, both in the plant and in grain, cowpea is considered the queen of areas with psamosoils, having multiple uses: human nutrition in the form of pods or beans, improvement of soil fertility by cultivating of the plant at crop rotations on sands, or by incorporation into the soil as green manure (Petre, 1981), in animal nutrition, through its participation, along sorghum and rye, when constituting dried fodder and ensiled (Ajeigbe and Singh, 2010). Due to of biological and morphological characteristics (very strong

root system, a high power absorption a wax layer on the leaf, which imprints a greater resistance to thermo-hydric stress conditions and the possibility of biological fixation of atmospheric nitrogen using symbiotic bacteria of the genus *Rhizobium*), cowpea are grown successfully in crop rotations from sandy soils area in Nigeria (Hamidou et al., 2007) and Romania (Draghici, 2000; Celac, 2009). The choice of variety with the best adaptability to dry areas, is a priority for research in terms of climate change.

MATERIALS AND METHODS

The research was conducted during 2012-2015 in Research - Development Center for Agricultural Plants on Sands, Dabuleni, and were aimed the study of 16 cultivars of cowpea in a comparative culture of competition, in order to introduce in culture of the most valuable. Experience has been placed on a sandy soil, with low natural fertility, containing 0.6 to 0.95% humus, being characterized as poorly stocked in nitrogen (0.07 to 0.075%), well stocked in extractable phosphorus (72 ppm and 88 ppm) and low to medium stocked in exchangeable potassium values (51 ppm and

117 ppm). In vegetation, have been registered determination for resistance cowpea cultivars by pathogens and pests, biometry measurements and plant productivity, and at harvest were determined quantity and quality of the production achieved (protein and fats). The results were interpreted in statistically, by analysis of variance and using mathematical functions.

RESULTS AND DISCUSSIONS

The climatic conditions prevailing in the sandy soils of southern Oltenia during 2012-2015, emphasizes accentuation of drought during the summer months, compared to the multiannual average (Figure 1), poor conditions for plant growth and development in this area. The phenomenon was accentuated during July - August, through increase of the average air temperature by 1.4-1.7°C, against the background recording a monthly average of 44.9 mm rainfall, which is of a non-uniform distribution.

Though rainfall recorded during the study period was above the multiannual average, was needed application 2-3 waterings with a

watering rate of 150-200 m³ of water, for completing consumption to cowpea plant, by 4160 m³, which is half the rate of consumption of soya (Marinică, 1994).

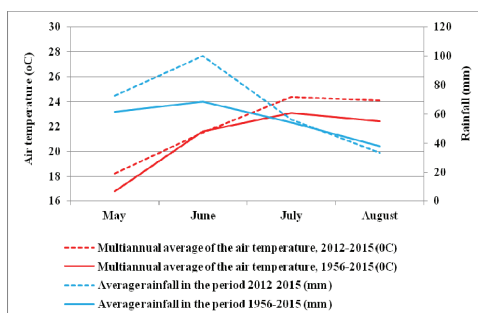


Figure 1. Climatic conditions prevailing at the meteorological station from R&DCFCSS Dabuleni

In sandy soil conditions, cultivars by cowpea have reached maturity over the course of 92-109 days, requiring approximately 1997.2 to 2499.9 °C. The earliest cultivation were: Aura 26, Aura, D4-1, Ofelia, and most delayed have been: Jiana, D12 / 2000 (Table 1).

Table 1. Biometric determinations regarding the development of the plant by cultivars cowpea

No.var.	Cowpea cultivars	Plant height (cm)	Foliar surface of one leaf (cm ²)	Leaf area index L.A.I.	The vegetation period days	Σ °C
1	Jiana	130.3	70.0	6.9	109	2499.6
2	Aura	110.5	54.0	5.0	93	2125.2
3	Aura 26	107.9	62.3	5.3	92	1997.5
4	Ofelia	120.7	62.4	5.4	98	2225.4
5	D2-3a	110.3	66.5	5.3	101	2289.2
6	D3-5	125.6	59.1	4.6	100	2281.3
7	D4-1	130.3	56.6	5.8	96	2176.7
8	D4-4	143.8	59.7	5.6	99	2251.2
9	D5-3	100.2	58.5	5.8	98	2235.9
10	D2-b/93	125.3	70.1	6.7	99	2267.7
11	D3/93	120.8	65.3	5.3	100	2285.8
12	D9/2001	120.7	63.4	6.1	100	2304.0
13	D12/2001	141.3	69.4	6.9	103	2359.6
14	D14/2001	123.8	56.7	5.4	100	2288.9
15	D8/2000	100.4	49.4	4.4	103	2365.4
16	D12/2000	143.2	69.3	6.5	104	2381.2
Average		122.2	62.0	5.7	99.7	2270.9

The cultivars studied, have recorded an average of plant height by 122.2 cm and a average of foliar surface of one leaf by 62 cm². Competition intraspecific of the plants, is conducted during foliar system development and root system, and the results show that it achieved greater increases by biomass energy as the plant is cultivated in an area as similar to of origin (Dadson, RB, 2005). The results obtained during the testing shows that cultivars by cowpea have developed a rich vegetative mass, with an index of leaf area, determined during blossoming period, by 4.4 to 6.9, based on which can be selected cowpea cultivars destination production of grain or biomass. Between the leaf area index and the production of grain, obtained from cowpea, there is a distinct negative significant correlation (Figure 2).

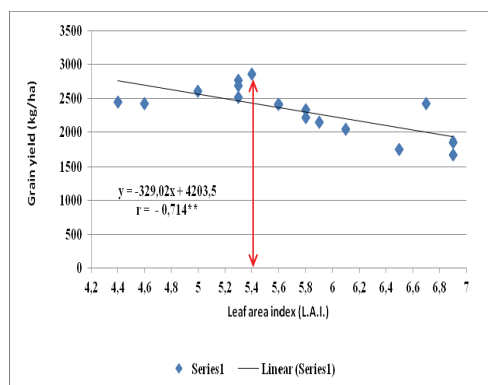


Figure 2. The correlation between leaf area index (LAI) and grain yield obtained from cowpea

The cowpea cultivars which developed an L.A.I. by 5 to 5.4 registered the highest yields of grain of 2603.7 to 2857 kg/ha (Ofelia, Aura, Aura 26, D2-3a, D3 / 93). As the cowpea cultivars developed a luxuriant vegetative mass, the process of fructification of the plant was lower, because light could not get to the flower vexil, essential condition in the process of fecundation of pollen. Analyzing the behavior by cowpea cultivars to attack pathogens and pests, under natural infection (Table 2), can notice a good behavior to Cowpea aphid borne virus infection, the frequency of plant attacked being in the range from 0 to 4.7. Infection with *Aphis fabae* of cowpea plant has a frequency range from 10.2

to 75%. At this pest, showed higher sensitivity cultivars D4-1, D3 / 93 and D12 / 2000. At harvest were determined frequency grains attacked by *Acanthoscelides obtectus*, and the results highlight as tolerant 11 cultivars and 5 cultivars with higher sensitivity, being attacked with a frequency greater than 50%.

Table 2. Resistance cultivars by cowpea to attack pathogens and pests

No. var.	Cultivars	The frequency of infection (%)		
		Virusul Cowpea aphid borne	Aphis fabae	Acanthoscelides obtectus
1	Jiana	0	10.2	25
2	Aura	0	20.7	35
3	Aura 26	0	21.3	34
4	Ofelia	0	25	38
5	D2-3a	1	16.3	50
6	D3-5	1	24	33
7	D4-1	1	75	22
8	D4-4	1.3	33.1	28
9	D5-3	0	24	75
10	D2-b/93	0	25.6	48
11	D3/93	1	62.3	55
12	D9/2001	1	25.4	50
13	D12/2001	4.7	15.3	25
14	D14/2001	0	18.6	26
15	D8/2000	0	43.5	38
16	D12/2000	1	68.5	62
Scale frequencies to pathogens		0-5	HR – Highly resistant	
		5.1-10	R- Resistant	
Scale frequencies to pests		0-50	T – tolerant	
		50.1-100	S- Sensitive	

The results concerning the productivity elements registered to cowpeas (Figure 3) indicates values differentiated depending on cultivar. The number of pods per plant varied within the limits of 7 to 13.6 pods / plant, with an average of 10.2 pods / plant. The number of grains per pod ranged from 10.1 to 12.2 and an average of 10.7 grains / pod and pod length was from 13.8 to 16.9 cm, with an average of cultivars by 15.1 cm. Were revealed through high values of productivity elements the cowpea cultivars: Aura 26, Ofelia, D2-b/93, Aura, D2-3a, D3-5, which recorded over 11 pods / plant and over 10 grains / pod.

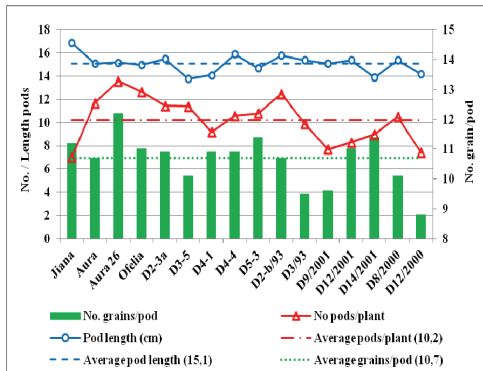


Figure 3. Differentiation the productivity traits registered at cowpea cultivars

Of the 16 varieties of cowpea studied under sandy soils, 10 were different from the statistical point of view, compared to the control genotype, Jiana (Table 3). Were registered very significant differences of production at cultivars Aura 26 and Ofelia, followed by cultivars Aura, D2-3a, D3/93, with production differences distinct significant. Thousand grain weight (TGW) has presented values ranging from 147.5 to 205.5 g, being a character variety.

Table 3. Production results obtained at cowpea cultivars in pedoclimatic conditions of the sandy soils from R&DCAPS Dabuleni

No.var.	Cowpea cultivars	Grain Yield (kg/ha)	The difference compared to the control		Significance	TGW g
			Kg/ha	%		
1	Jiana	1677.2	Control	100	Control	186
2	Aura	2603.7	925.8	157	**	190
3	Aura 26	2771	1083,8	167	***	188.5
4	Ofelia	2857.7	1186,8	172	***	185.5
5	D2-3a	2683.3	1006.1	162	**	168
6	D3-5	2420	742.8	146	*	190
7	D4-1	2331.7	654.5	141	*	189
8	D4-4	2407.7	729.8	145	*	188
9	D5-3	2219	541.8	134	-	147.5
10	D2-b/93	2427	749.8	146	*	153.5
11	D3/93	2513	835.8	152	**	169
12	D9/2001	2044.3	367.1	123	-	205.5
13	D12/2001	1854	176.8	112	-	165
14	D14/2001	2143.7	466.5	129	-	163.5
15	D8/2000	2439	761.8	147	*	183
16	D12/2000	1758.7	81.5	106	-	183

LSD 5% 542.8 kg/ha
 LSD 1% 774.5 kg/ha
 LSD 0.5% 1028.7 kg/ha

Analyzing the functional link between production and the number of pods per plant, to the 16 cultivation of cowpea experienced in 2012-2015 period, it highlights a positive correlation distinct significant ($r = 0.904^{**}$), which shows that with increasing number of pods the grain yield obtained recording an upward trend (Figure 4). Also, there is a negative correlation, distinct significantly, between the grain yield and vegetation period ($r = - 0.712^{**}$). The shortening the vegetation

period at cowpea cultivars with higher yield is because to them, the development of shoots from the basal buds is more inhibited, that after the growth of the leaves metafile stems, evolution of generative organs becomes dominant (Drăghici, 1999). The prolongation of vegetation cowpea can be determined, also, by the non-uniformity in baking of the pods, unwanted character in the breeding of this species

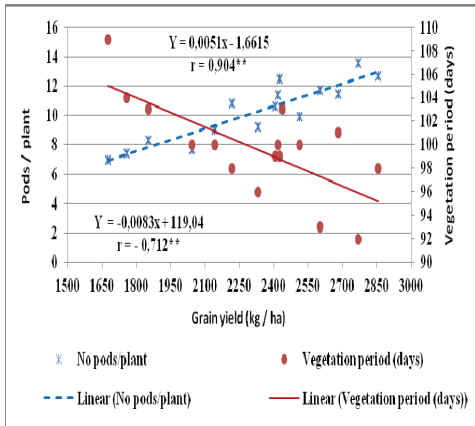


Figure 4. Correlation between the grain yield to cowpea and number of pods / plant and vegetation period

Analysis on grain quality by cowpea cultivars studied in sandy soils conditions, reflects an average protein by 22.4%, with values within limits from 20.5 to 23.8%, emphasizing in this regard cultivars: D12 / 2000, Aura 26, Aura, Ofelia, D2-b / 93, D4-4, D9 / 2001, which exceeded with 0.9 to 2.2%, the control cultivar (Figure 5). The fats content varied depending on the cultivar, from 1.9 to 2.9%, with an average of 2.5%.

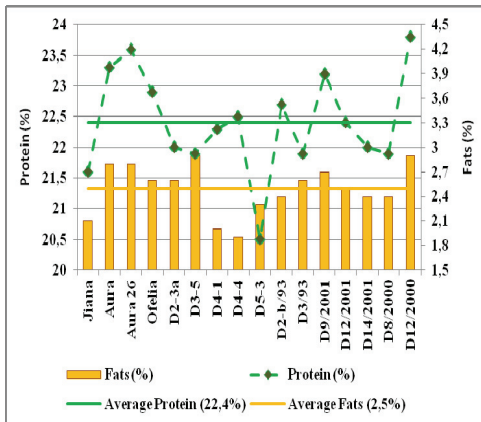


Figure 5. Quality of the cowpea production, depending on the cultivar

CONCLUSIONS

In sandy soil conditions, the cultivars of cowpea registered a vegetation period in 92-109 days, requiring approximately 1997.2 to 2499.9°C, for maturing. The earliest cowpea

cultivars were: Aura 26, Aura, D4-1, Ofelia, and most late were Jiana, D12 / 2000.

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