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VARIABILITY OF GENETIC RESOURCES OF COWPEA (VIGNA UNGUICULATA) STUDIED IN THE SANDY SOIL CONDITIONS FROM ROMANIA

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ABSTRACT

In order to achieve an efficient system of agriculture in sandy soils of southern Romania and promote sustainable agriculture, must be found that species of plants that are more easily to thermal-hydr conditions in this areas. Cowpea (Vigna unguiculata L. Walp), is one of the plants which recover very well the specific climatic conditions of the area psamo-pelitic soils in southern Romania, being a plant resistant to drought, with reduced requirements to soil fertility.The results obtained during the 2009-2015 from Development Research Center for Plants Crops on Sands, Dabuleni, Romania, concerning the behavior of 144 genotypes of cowpea, revealed variability of the species, in terms of morphology and plant productivity. Of the 144 genotypes studied, 38% allow selection for obtaining varieties of cowpea for grains, 26% allow for selection of genotypes of cowpea for feed, and 36% allow selection of obtaining genotypes for green manure. Grain yield obtained from cowpea was negatively correlated with rainfall.

INTRODUCTION

A native of Central Africa, cowpea (Vigna unguiculata L. Walp) is considered one of the oldest cultures grain legumes on three continents of the "Old World". By biological characteristics plant, concerning high resistance to drought and reduced requirements to soil fertility, cowpea can be a good alternative for bean cultivation of grain also for crop soybean, plants very sensitive to stress factors in areas with excessive drought (Drăghici Reta, 2013, Marinica Gh., 1994).Compared with beans, cowpea has a very strong root system, with a high power absorption, a waxy coating on the leaves, which imprints a greater resistance to climatic conditions that is realized in the sandy soils. Frequently, high temperatures from the ground surface (+ 60 °C), accompanied by low air humidity, lead to abortion of flowers of beans, partially or totally compromising the culture (Baudoin J.P., Marechal R., 1990, Dadson, R. B. Et all., 2005). Stomatal closure is the common strategy used by various genotypes of cowpea, to avoid dehydration foliage, and stomatal variance in conductance genotypic increases considerably in drought conditions (Anyia, A. O. and Herzog, H., 2004, Hamidou, F. Et al., 2007). Food safety is based, among others, and ensure genetic progress in agriculture, which is based on the evaluation of germplasm resources available to cowpea, and its specificity for dry conditions (Boukar O, F. et al., 2010, Reta Drăghici, 2003, Sarah Hearne et al., 2010). As a result of the high content of protein, both in the plant and in grain, cowpea are considered the queen of areas with psamosoils, having multiple uses: in human nutrition in the form of pods or beans, to improve soil fertility by cultivating the plant cropping on sand or soil incorporation as green manure, in animal nutrition, through its participation with the establishment rye sorghum or dried fodder and silage (Karp Angela Ian Shield, 2008, Zăvoi A., Bleoju Maria, 1989). To

promote a sustainable agriculture, we have found those plant genotypes that are more easily converted thermo-hydric to stress conditions, and in this sense cowpea is one of the plants that use highly specific climatic conditions of the area psamo-pelitic soils in southern Romania, which is why was studied germplasm collection comprised of 144 genotypes.

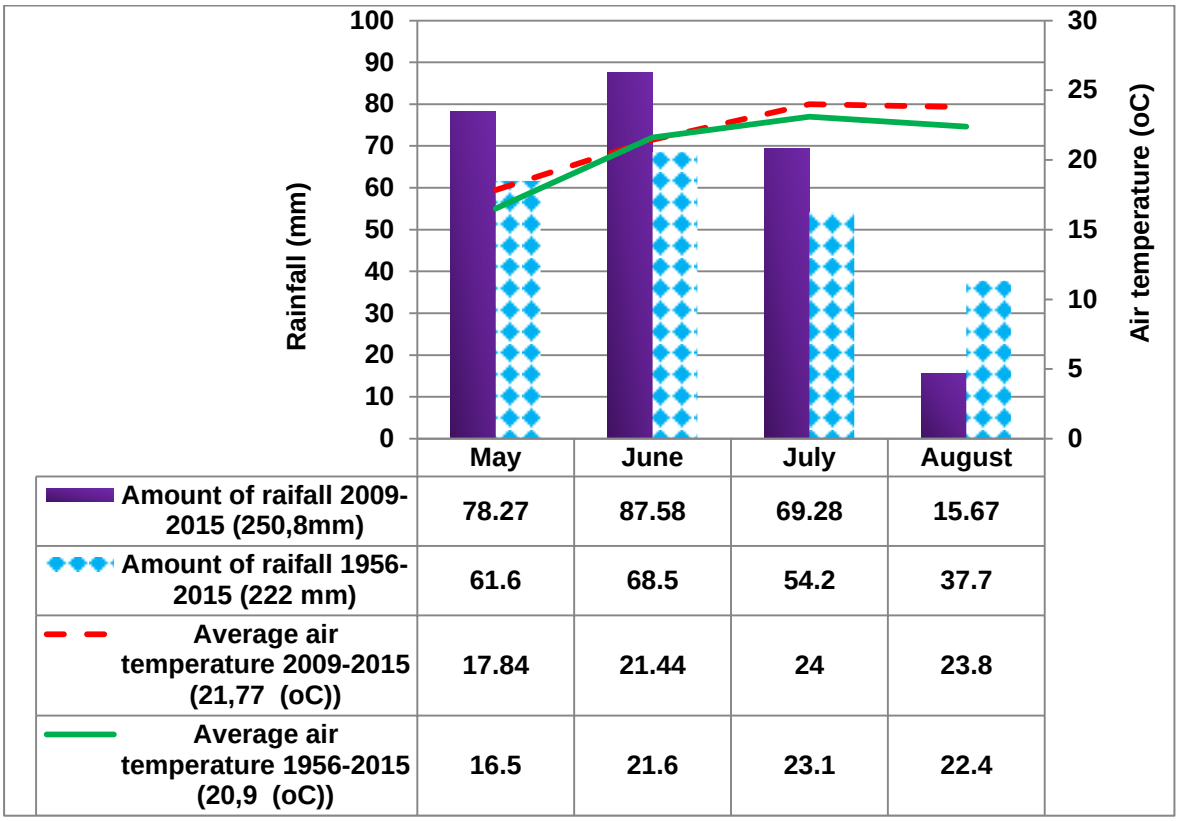
MATERIAL AND METHODS

The researches were conducted during 2009-2015 on a collection of germplasm from cowpea (Vigna unguiculata L. Walp), which included 144 genotypes collected in the country (Foto 1). The study was conducted in conditions of irrigation on a psamosol with reduced fertility, poorly stocked in nitrogen (0.035%), middle stocked in phosphorus (25.5 ppm) and with low potassium (127ppm). Experience was placed in a 3-year rotation: cowpea - rye – sorghum to Development Research Center for Plants Crops on Sands, Dabuleni, Romania. The genotypes of cowpea were sown in the period 1 to 10 May, when average soil temperature was 10 -12^{0}C, being fertilized with 60 kg / ha N, 60 kg / ha P_2O_5 and 60 kg / ha K_2O. Determinations were carried out on the development of plant, on the physiological resistance to pests agencies, the number of pods per plant, number of grains in pod and grains production.

Photo 1. Image of field research to cowpea (Vigna unguiculata)

RESULTS AND DISCUSSIONS

In Romania, droughts constitute a specific characteristic of due to the geographical location of our country in a temperate climate zone excessive, with very large deviations from normal values of climatic parameters, agro-climatic, hydrological and pedological. Analyzing the climatic conditions at weather station from Dabuleni Development Research Center for Plants Crops on Sands (Figure 1), is highlighted strongly increasing monthly average temperatures compared to the annual average, which combined with the rainfall recorded at the stages of vegetation critical process often causes stagnation of growth and development of cowpea plants by inhibiting plant physiological processes and create favorable conditions pathogens attack. The average air temperature in the vegetation period genotypes of cowpea, exceeded the annual average 0.87 ^{0}C. The amount of degrees of temperature recorded during the growing season was about to 2155.23 ^{0}C, ensuring optimal conditions for growth and development of genotypes of cowpea. Research conducted in this regard on the sands of southern Oltenia, showed that cowpea requires about 2000 ^{0}C during the season period whichis conductedover a period of 93-104 days (Reta Drăghici, 2003, Zăvoi A., Bleoju Maria, 1989).



	May	June	July	August
Amount of raifall 2009-2015 (250,8mm)	78.27	87.58	69.28	15.67
Amount of raifall 1956-2015 (222 mm)	61.6	68.5	54.2	37.7
Average air temperature 2009-2015 (21,77 (oC))	17.84	21.44	24	23.8
Average air temperature 1956-2015 (20,9 (oC))	16.5	21.6	23.1	22.4

Figure 1. Climatic conditions at the weather station RDCSPS, Dabuleni in the study period og cowpea germplasm

During vegetation, the cowpea plants are frequently infected with various pathogens, but the virus cowpea aphid borne, which is transmitted by the bite of aphids, can cause great damage to plant of cowpea and choice of material biologically healthy is a means to streamline the culture (Cojocaru Doina et. al., 1996, Ofuya T. I., 2008).The results obtained in the dry savanna of North-West Nigeria, from Institute for Agricultural Research (IAR) and Ahmadu Bello University (ABU), Zaria area of Nigeria, revealed correlations between the drought resistance and certain genotypes of cowpea and selection of new sources of genes for Striga and aphid (Aphid craccivora Koch) resistance (M.F. Ishiyaku and H. Aliyu, 2013). Analyzing the plants resistance to virus Cowpea aphid borne from 144 genotypes of cowpea, studied on the sandy soils from southern Romania, in phases 3-4 true leaves and blooming, is noted very good resistance to this pathogen a majority genotypes studied (grades 1-2). The results obtained, show a distinct significant negative correlation, between infection with the virus cowpea aphids borne and grain yield (Figure 2). The determinations made at flourished, as regards type of plant growth, allows selection and use of the cowpea biotypes in breeding plant process of plant, according to the the desired variety. Of the 144 cowpea genotypes studied, 38% allows selection to obtaining varieties of grain, 26% allows selected genotypes for feed, and 36% allows selection of obtaining genotypes for green manure (Figure 3).

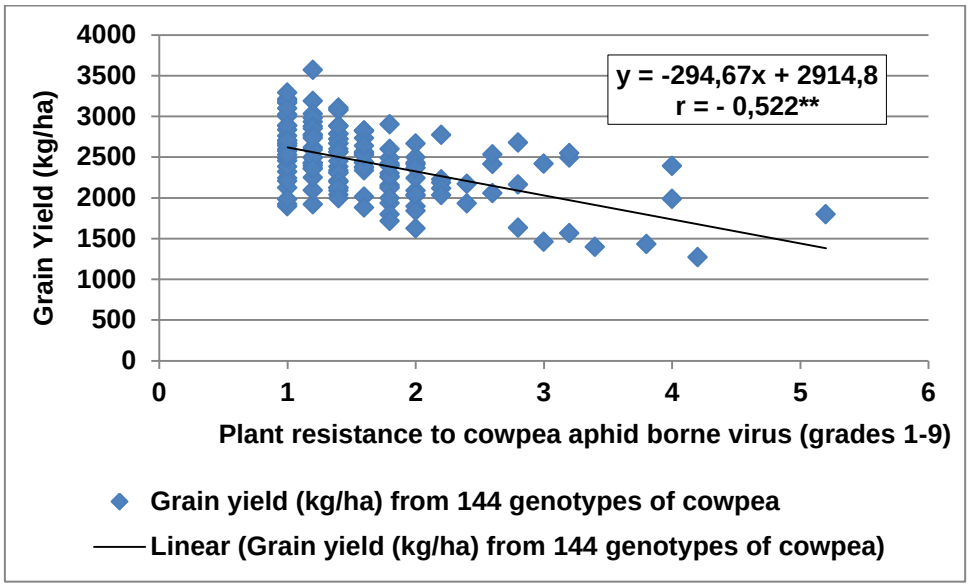


Figure 2. The correlation between grain yield obtained to an assortment of 144 a genotypes of cowpe and Cowpea aphid borne virus infection

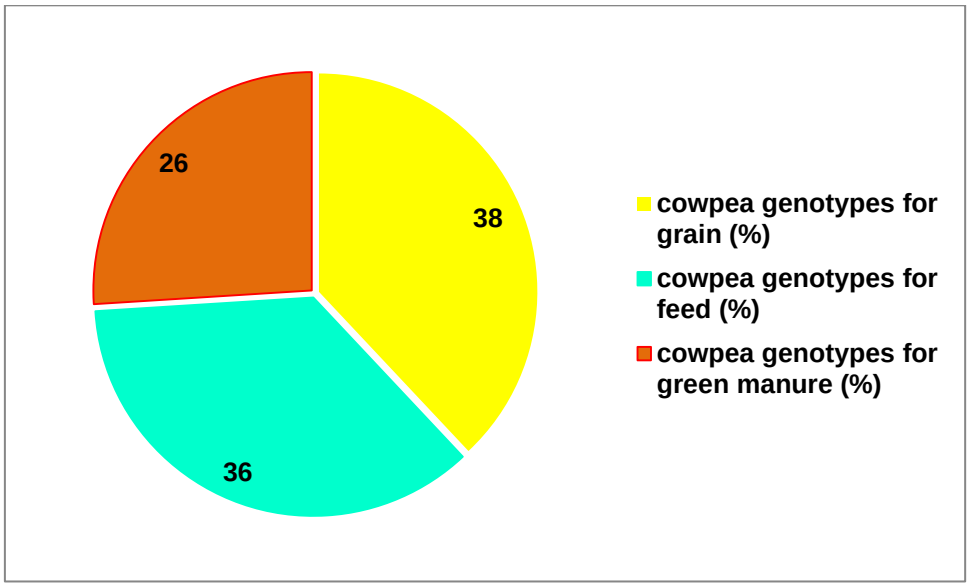


Figure 3. Morphological diversity of cowpea genotypes studied in the Dabuleni

Within the species Vigna unguiculata, the pod is a character with a great variability, in terms of shape, size, color, number of grains, etc. At the 144 genotypes of cowpea the number of pods per plant varies between 8.02 - 19.89 pods, with an average of 12.87 pods / plant, number of seeds in pods varies between 8.1 -11.98 grains / pod with an average of 10.05 grains in pod, the pod length varies between 11.85 and 18.8 cm, with an average of 15.13 cm (Table 1). The grain yield varied from 1269.27 to 3567.14 kg / ha, with an average of 2422.05 kg / ha. From the average were recorded production differences, between -1152.77 kg / ha and 1145.08 kg / ha, with an distribution over average of 52.2% of the genotypes (Figure 4).

Table 1

The characterization of cowpea germplasm, studied under conditions of sandy soils

Characters of productivity to cowpea germplasm	2009-2015 Period		
	Average	Minimum	Maximum
No. Pods/plant	12.87	8.02	19.89
Pod length (cm)	15.13	11.85	18.8
No. grains in pod	10.05	8.1	11.98
Grain yield (kg/ha)	2422.05	1269.27	3567.14

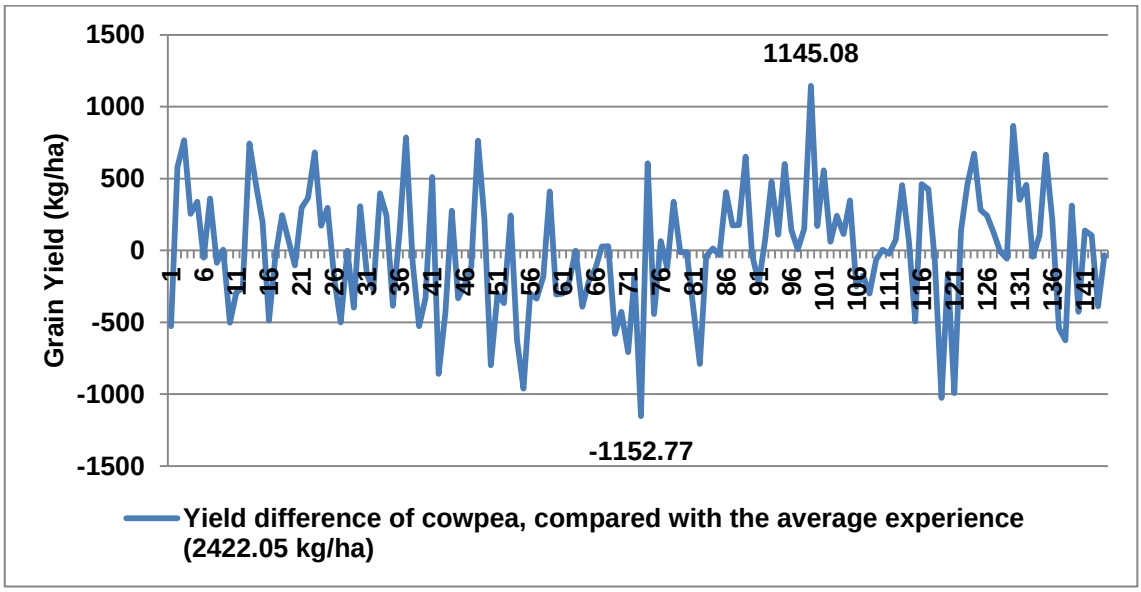


Figure 4. Difference of cowpea genotypes production, compared to the average experience

Between production of grain recorded at the 144 genotypes of cowpea and pods per plant number, there is a distinctly significant positive correlation, r = 0.358 ** (Figure 5). The pods are forming floral axes, their number reaching and 6 pods / floral axis in conditions of vegetation, being differentiated by genotype. When conditions during flowering are unfavorable (drought persist), the flowers aborting from one level to another. In this case, the floral axis is prolonged constantly giving birth to new flowers, until the emergence of favorable conditions for fertilization, that pods can form at the tip axis. Production results obtained from cowpea can be influenced by the rainfall. If we analyze the yields obtained in the 7-year study correlated with rainfall recorded during the growing plant (May-August) is observed a polynomial correlation II, which showsan ascendant trend of production up to a value of 3104.04 kg/ha when it recorded a 233.2 mm rainfall, after which production decreases with increasing precipitation (Figure 6). In terms of rainfall, is registered a luxuriant plant grows at the expense of the fructification.

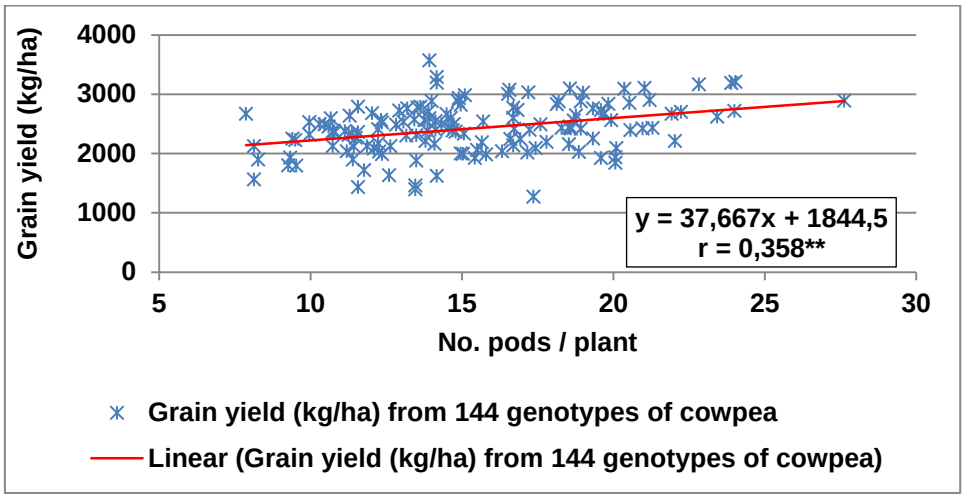


Figure 5. The correlation between grain yield and number of pods / plant to cowpea

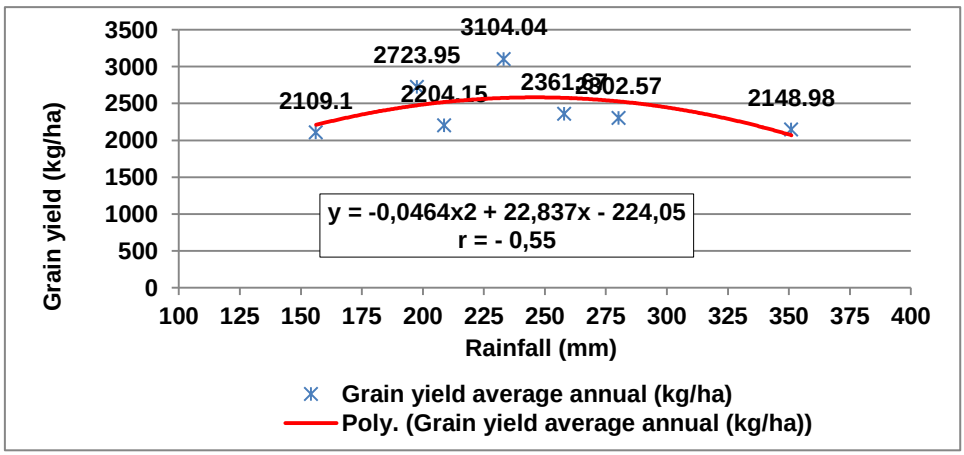


Figure 5. The correlation between grain yield obtained at 144 cowpea genotypes and the annual amount of rainfall, recorded during the growing season

CONCLUSIONS

The areaof sandy soilsfrom the south Oltenia provides an optimal microclimate for growth and development of cowpea plant.

At the 144 genotypes of cowpea the number of pods per plant varies between 8.02 - 19.89 pods, with an average of 12.87 pods / plant, number of seeds in pods varies between 8.1 -11.98 grains / pod with an average of 10.05 grains in pod, the pod length varies between 11.85 and 18.8 cm, with an average of 15.13 cm

The grain yield of 144 genotypes of cowpea, ranged between of 1269.27 to 3567.14 kg / ha and an average of 2422.05 kg / ha, was negatively correlated with infection by cowpea aphids borne virus and the amount of rainfall and positively with the number of pods per plant.

Diversity of germplasm cowpea (38%, specific genotypes for grain yield: 26%, specific genotypes feed and 36%, specific genotypes green manure), allows the selection of genetic material used in the improvement of the plant, depending on the intended objective in improvement.

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