Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of Plant Sciences 6 (2): 435-437, 2007
ISSN 1682-3974

Inheritance of Time to First Flower in Photo-insensitive Cowpea (*Vigna unguiculata* (L.) Walp.)

[1]A.O. Adeyanju, [1]M.F. Ishiyaku and [2]L.O. Omoigui
[1]Department of Plant Science, Institute for Agricultural Research,
Ahmadu Bello University, P.M.B. 1044, Zaria, Nigeria
[2]International Institute of Tropical Agriculture, Ibadan, Nigeria

Abstract: Early maturity is a relatively important agronomic trait and is important in the adaptation of annual crops, including cowpea to any agro ecological zone. This trait was studied using days to first flowering under screen house condition to determine heterotic effects, heritability and inheritance of early heritable (h^2ns) was 98.9% while (h^2bs) was 68%. The F_1 hybrid performed better than the average parent by 8.82 and 23.3% over the superior parent. Transgressive segregation was observed in the F_2 population with plants flowering 9 days earlier than the early parent and 37 days later than the late maturing parent. Inheritance of earliness was observed to be controlled by duplicate dominant epistasis with late flowering partially dominant over early flowering.

Key words: Days to first flower, heterosis, heritability, cowpea, inheritance

INTRODUCTION

Cowpea is an important food legume and an essential component of cropping systems in the dry regions of the tropics covering parts of Asia and Oceania, the Middle East, Southern Europe, Africa, Southern USA and central and southern America (Perrino *et al*., 1992, 1993). An estimated world total of about 14.0 million ha is grown to cowpea with a production of 4.5 million tonnes (t) (Singh *et al*., 1997). Nigeria is the largest producer and consumer of cowpea with about 5 million ha and over 2 million tonnes (t) production annually. However, being a drought tolerant crop with better growth in warm climates, cowpea is most popular in the semi arid regions of the tropics, where other food legumes do not do well. Cowpea has the unique ability to fix nitrogen. Also, it is shade tolerant and therefore compatible as an intercrop with a number of cereals and root crops. Its quick growth and rapid ground cover have made cowpea an essential component of subsistence agriculture in marginal lands and drier regions of the tropics where rainfall is scanty and soils are sandy with little organic matter.

The duration from sowing to flowering in cowpea is an important component of adaptation of cowpea to any particular agro ecological zone (Northern Guinea savannah, Sudan and Sahel savannah). The timing of flowering determines when crops ripen for harvest. In Arid and Semi-arid regions, short duration cowpeas, which mature from 55-60 days, are ideal for the short growing season where rainfall ends abruptly or soil has low moisture holding capacity. In intercropping systems, short duration cowpea fit an intercrop with maize, sorghum, pearl millet, cassava and cotton. It is also ideal for intensive cropping patterns in irrigated areas (Varkey and Jacob, 1979). Early maturity is a relatively important agronomic characteristic. Early maturity is preferred everywhere so that cowpea can be grown in niches of cereal based cropping systems. Typically, the trait is measured by such criteria as day to flowering or days to maturity. Information on the inheritance of days to first flower will help breeders develop strategies for improvement of seed yields and their adaptation to various agroclimatological zones. This study aims at obtaining information on heterosis and mode of inheritance of days to first flower in cowpea.

MATERIALS AND METHODS

The screen house experiment was conducted in 2000 at the Institute for Agricultural Research, Samaru, Zaria. Nigeria (07°38'E, 11°11'N, 686 m ASL). Soil type was a fine-loamy, isohyperthermic plinthusstalf; USDA taxonomy. Two genotypes were used in this study. IT90K-76 (Early maturity 60 days) and IAR 48 (Late maturity 80 days). Genotype IT90K-76 (P_1) was the better parent with respect to early maturity. Hand crossing was

Corresponding Author: A.O. Adeyanju, Department of Plant Science, Institute for Agricultural Research, Ahmadu Bello University, P.M.B. 1044, Zaria, Nigeria

used to develop the F_1 hybrid. To achieve synchronization of flowering periods, IAR 48 was planted earlier than IT90K-76. The initial crosses as well as F_2 population were generated in the screen house. The parents, F_1 and F_2 populations were evaluated in a completely randomized design with three repetitions. Each repetition has 12 plastic pots.

A total of 36 plastic pots (Each 228 mm in diameter, 8.6 L in volume) were used. Six seeds of each population were planted in the plastic pots filled with fresh topsoil (composition: Soil/sand mixture). The seedlings were thinned to three plants per plot at 2 Weeks after Planting (WAP) to maintain a population of nine plants for the three pots per population. This constituted a repetion. Prior to sowing, 1.0 g of compound fertilizer (15:15:15 NPK) at the rate of 100 kg ha^{-1} were incorporated into each pot. The potted plants were watered daily to field capacity using watering tank throughout the growth period of the plant. A mixture of karate 25EC and Mycotrin 80WP at the rate of 37.5 g a.i. ha^{-1} and 62.5 g to 10 L of water, respectively was sprayed at 7 days interval to control flowering and post-flowering insect pests. Weeds were controlled by hand pulling as and when necessary throughout the growing period of the crop. Observations on days to first flower were collected on per plant basis. Heterotic effect was computed from entry means as described by Gomez and Gomez (1984). Heritability was estimated according to Allard (1967). Chi-square analysis was used to determine the fit of the F_2 segregation ratio for days to first flower.

RESULTS AND DISCUSSION

Average performance of parents, F_1, heterosis and heritability in broad and narrow sense for days to first flower are shown in Table 1.

The positive low heterosis of mean above mid-parent and better parent suggests partial dominance of late flowering over early flowering. Dominance of late maturity over early maturity has been reported by Mak and Yap (1980). Heritability in the broad sense was (68%) while Narrow sense heritability was high (90.89%) suggesting that days to first flower is highly heritable and that selection for improvement in the F_2 or early generation will be effective in improving earliness. Similar high habitability has been reported for days to flowering by Sharma and Singhania (1992).

Table 2 shows range, means, Standard error, variance and coefficient of variation for days to first flower. Highest variance was observed in the F_2 confirming genetic segregation for days to first flower. Transgressive segregation was observed from the range of the F_2 population with plants flowering earlier than the early parent (P_1) in 21 days and later than the late flowering parent (P_2) in 75 days. The wide range observed confirms presence of variability. The transgressive segregates have not been reported before. This suggests that the two genotypes contain genes which when combined in the same background give rise to different genotypes which bring those earlier and later than both parents.

Table 3 shows the segregation for days to first flower. The hybrid for the cross was not significant at 1% for the expected ratio 3: 1 (Late: Early) thereby indicating a good fit of the observed segregation to this ratio. In the F_2 population, Chi-square values at the expected 15:1 (Late: Early) at 1% was not significant indicati ng a good fit. This suggests that days to first flower are controlled in part by dominant genes at two or more loci. This is in agreement with Ojomo (1971) who reported that duplicate dominant epistasis between two major genes in the presence of some minor modifying genes are responsible for days to first flower.

Table 1: Average performance of parent, F_1 percentage heterosis, over dominance and heritability of days to first flower in cowpea

Cross	Generation mean			Heterosis over	Heterosis over
IAR 48xIT90K-76	P_1	P_2	F_1	mid-parent	better parent
	30	38	37	8.82	23.33
h^2_b	68%				
h^2_n	90.87%				

h^2_b = Broad sense heritability, h^2_n = Narrow sense heritability

Table 2: Range, mean, standard error, variance and coefficient of variation of days to first flowering for the entries

Generation	Range	Mean	SE	Variance	CV (%)
P_1	28-47	30	±1.83	53.6	19.3
P_2	29-48	38	±0.55	3.6	6.3
F_1	26-45	37	±2.64	55.6	20.2
F_2	21-75	47	±0.93	11.8	23.3

SE = Standard Error, CV = Coefficient of Variation

Table 3: Segregation of days to first flower in populations of the cross IT90K-76 and IAR 48

	No. of plants		Chi-square value at expected ratio				
Generation	Late	Early	3:1	1:1	9:7	13:3	15:1
P_1	0	12					
P_2	16	0					
F_1	6	3	0.33^{ns}				
F_2	124	12	18.9**		67.41**	8.79**	1.53

*Significant at 5%, ** Significant at 1%, ns = Non Significant

In conclusion, this study revealed variability for day to first flower with transgressive segregates flowering earlier and later than both parents and that earliness is controlled in part by dominant genes at two or more loci.

REFERENCES

Allard, R.W., 1967. Principles of plant breeding. N.Y. London. John Wiley and Sons.

Gomez, K.A. and A.A. Gomez, 1984. Statistical Procedure for Agricultural Research. Willy-Interscience Publication. 2nd Edn., pp: 608.

Mak, C. and T.C. Yap, 1980. Inheritance of seed protein content and other agronomic characters in longbean (*Vigna sesquipedalis* Fruw.) Theoretica and Applied Genetics, 56: 233-239.

Ojomo, O.A., 1971. Inheritance of flowering date in cowpea (*Vigna unguiculata* (L.) Walp.). Trop. Agric. (Trinidad), 48: 277-282.

Perrino, P., T. Shgarodsky, M. Esquivel, H. Uranga and K. Hammer, 1992. The cultivated races of *Vigna savi* in Cuba. Feddes Reportorium, 103: 509-514.

Perrino, P., G. Laghetti, P.L.S. Zeuli and L.M. Monti, 1993. Diversification of cowpea in the Mediterranean and other centers of cultivation. Gene. Resou. Crop. Evol., 40: 121-132.

Sharma, C.D. and D.L. Singhania, 1992. Performance of cowpea (*Vigna unguiculata* (L.) Walp.) genotypes for fodder traits. Ann. Arid Zone, 31: 65-66.

Singh, B.B., S.K. Asante, D. Florini, L.E.N. Jackai, C. Fatokun and K. Wydra, 1997. Breeding for multiple disease and insect resistance. IITA Annual Report. 1997. Project II. Page 22.

Varkey, P.A. and S. Jacobs, 1979. Screening of cowpea varieties for the rice fallows. Agric. Res. J. Kerala, 17: 120-121.