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Evaluation of Exotic Material of Chickpea (*Cicer arietinum*) under Bahawalpur Agroclimatic Condition

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Abstract: Studies were e conducted on forty one chickpea genotypes from Spain, India, Syria and Egypt to evaluate their performance under local conditions, their subsequent use in breeding programme and to establish a selection criterion for varietal improvement in chickpea. The genotype FLIP 97-149C exhibited high physiological efficiency with maximum harvest index of 41.5% followed by FLIP 97-28C (39.1%). Maximum economic yield was found to be 165g for FLIP 97-149C followed by Sel 93TH24483 (139g). Biological yield was maximum for the genotype FLIP 97-95 C (950g) followed by FLIP 93-260C, FLIP 96-90C, FLIP 97-116C AND Sel 93TH24483 (500g each). Biological yield and harvest index showed negative correlation (r^2=-0.025) while economic yield and harvest index were positively correlated (r2 = +0.698) and economic yield (r^2 = +0.598) and harvest index (r^2 = +0.398). The results suggested that the yield of chickpea could be improved by improving the harvest index.

Key words: Chickpea, genotypes, biological and economic yield, harvest index, correlation, Bahawalpur

Introduction

Chickpea (Cicer arietinum) is Pakistan's most important pulse crop. It was grown on an area of 0.87 million ha with a production of 0.39 million tons in Punjab during 2001-2002, as against area of 0.99 million ha with a production of 0.44 million tons on Pakistan basis. There was a gap of 0.28 million tons between production (0.44 million tons) and total country's chickpea requirement (0.72 million tons) (Anonymous, 2002). A huge amount of foreign exchange is being spent on the import of 0.28 million tons of chickpea to meet the deficit. This situation necessitates that the chickpea varieties possessing higher yield potential compared to the existing ones should be developed to fill the gap between availability and consumption of chickpea in the country.

Identification of better genotypes with desirable traits and their subsequent use in breeding programme and establishment of suitable selection criterion can be helpful for successful varietal improvement programme.

Ration between biological yield and economic yield is known as harvest index, which is consisted of the partitioning if vegetative and reproductive stages of the plant. Generally, the pulses exhibit low harvest index as compared to cereals. Biological yield and harvest index are closely related to sink size, source activity and sink source ratio (Park, 1988). Photosynthesis, dark reaction and the partitioning of assimilates are the essential prerequisites for increased and stable plant productivity (Olsen, 1982).

Adequate production of photosynthetic assimilates and an adequate storage capacity to accept the photosynthetic products are positively correlated with yield. Singh *et al*. (1980) and Malik *et al*. (1981, 1986) have reported varietal difference for harvest index in chickpea and mung. Fida *et al*. (1993) evaluated 25 early maturing rice genotypes for physiological efficiency to select the best one for use in future breeding programme. They found highly significant positive correlation (r^2= + 0.696) between harvest index and grain yield while negative correlation (r^2 = -0.052) between harvest index and grain yield while negative correlation (r^2 = -0.52) between harvest index and biological yield. The doubling of pod yield in peanut was due to primarily to increased harvest index rather that to increased total yield (Gifford *et al*., 1984). On the basis of such results, the attention has been focused on harvest index as a specific selection criterion for plant breeders. The present studies were therefore, conducted to identify the physiologically efficient genotypes (If any) in recently introduced exotic chickpea genotypes for their further utilization in a breeding programme at Bahawalpur and to establish a selection criterion for improvement in chickpea programme.

Materials and Methods

Forty chickpea genotype alongwith one check (ILC 533 (Egypt)] of diverse origin (Spain, India, Syria and Egypt) were tested at Regional Agricultural Research Institute, Bahawalpur, during rabi 2001-2002. The experiment was laid out according to Randomized complete block design with two replications keeping plot size of 0.90 m^2. All recommended agronomic practices like weeding, hoeing and plant protection measures were adopted as and when required equally for all plots. Data on days taken to 50% flowering, days taken to 90% maturity, plant height, biological yield (above ground biomass just before thrashing), economic yield and 100-seed weight were recorded. Harvest index was calculated by using the formula of Yoshida (1981) as under:

$$\text{Harvest index \%} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

The data were analyzed statistically by using 'MSTATC' a computer package. Correlations were computed by using the "Correlation" sub-programme of the same package.

Results and Discussions

Data given in Table 1 revealed that days taken to 50% flowing ranged from 90-115, days taken to 90% maturity from 126-145, plant height from 23-72 cm, 100-seed weight from 10-32 g, biological yield from 80-950 g, economic yield from 13-165 g and harvest index from 10-41.5% (Table 1). Maximum biological yield was produced by FLIP 97-95C (950 g) followed by ELIP 93-260C, FLIP 96-90C, FLIP 97-116C and Sel 93TH24483, which gave 500g each. Sel 95 TH1744 and Sel 95 TH1745 exhibited minimum biological yield (80g). FLIP 97-149C had the maximum economic yield (165g) followed by Sel 93 TH24483 (139g) and Flip 97-28C (136g). Genotype Sel 95 TH1745 had the minimum economic yield of 13g. Genotypes FLIP 93-255C, FLIP 93-260C and FLIP 97-81C had the lowest harvest index i.e. 10%. The highest harvest index was observed for the FLIP 97-149C (41.5%) followed by FLIP 97-28C

Table 1: Data of various traits of chickpea genotypes at Regional Agricultural Research Institute, Bahawalpur during 2001-2002

Genotypes	Days taken to 50% flowering	Days taken to 90% maturity	Plant height (cm)	Biological yield (g)	Economic yield (g)	100-Seed weight (g)	Harvest index (%)
ILC 8262	108	136	54	400	66	26	16.6
FLIP 93-255	112	142	47	350	35	22	10.0
FLIP 93-260	115	142	50	500	40	20	10.0
FLIP 93-262	101	140	58	450	128	25	28.4
FLIP 95-90	97	133	55	500	117	30	23.6
FLIP 97-28	91	127	65	350	136	29	39.1
FLIP 97-81	115	137	55	320	30	20	10.0
FLIP 97-83	101	136	43	200	60	18	30.1
FLIP 97-95	92	129	56	950	112	29	11.8
FLIP 97-112	104	137	55	200	32	20	16.2
FLIP 97-115	103	133	52	300	69	24	23.1
FLIP 97-116	101	130	52	500	129	29	25.9
FLIP 97-121	94	131	61	380	62	29	16.4
FLIP 97-126	108	133	45	150	22	15	14.8
FLIP 97-135	102	133	50	150	42	16	28.2
FLIP 97-136	93	133	56	300	100	25	33.4
FLIP 97-149	92	130	58	400	165	29	41.5
FLIP 97-150	106	135	50	120	30	22	25.1
FLIP 97-168	95	131	64	300	67	25	22.4
FLIP 97-173	99	131	60	250	70	29	28.0
FLIP 97-179	104	133	44	300	90	20	30.1
FLIP 97-182	95	131	57	400	127	25	31.9
FLIP 97-187	103	130	52	300	84	26	28.1
FLIP 97-192	110	140	35	200	45	22	22.5
FLIP 97-221	102	133	60	400	109	28	27.5
FLIP 97-230	93	129	51	300	85	30	28.6
FLIP 97-231	106	137	50	200	45	18	23.2
FLIP 97-232	101	133	48	320	119	22	37.3
FLIP 97-239	94	126	72	300	100	31	32.9
FLIP 98-16	102	132	65	200	45	16	22.6
FLIP 98-50	107	138	42	150	20	16	13.3
FLIP 98-108	90	127	60	250	82	32	33.0
Sel 96 THI 1403	108	142	23	100	15	18	13.2
Sel 93 TH 24460	107	136	43	300	74	29	25.5
Sel 93 TH 24464	96	128	52	350	79	22	22.6
Sel 93 TH 24469	103	140	57	350	49	22	14.1
Sel 93 TH 24483	105	141	52	500	439	21	25.4
Sel 95 TH 1716	111	140	34	250	35	26	14.0
Sel 95 TH 1744	108	141	30	80	16	21	20.0
Sel 95 TH 1745	112	139	32	80	12	15	16.3
ILC 533	115	145	55	200	30	10	15.1
Mean Squares	100.81	48.180	204.75	49295.61	3288.91	53.66	139.07
Probability	0.00	0.000	0.00	0.00	0.00	0.00	0.00
CV (%)	2.53	2.33	6.89	11.19	6.22	11.25	11.98

Table 2: Correlation coefficients among biological yield, economic yield, 100-seed weight and harvest indices for 41 genotypes

	Traits		
Traits	Economic yield	100-seed weight	Harvest index
Biological yield	+0.642**	+0.455**	-0.25NS
Economic Yield		+0.598**	+0.698**
100-Seed weight			+0.398**

** Highly significant NS = Non significant

(39.1%) and FLIP97-232c (37.3%) exhibiting their physiological efficiency for appropriate partitioning of total biomass into straw and seed. The check variety ILC 533 showed the poorest performance. Other genotypes in the trial were efficient in accumulating dry matter but inefficient in partitioning of assimilated dry matter into seed. Statistical analysis of the data revealed highly significant differences among the mean values for all the traits (P<0.01) (Table 1). Maximum variation in harvest index percentage (14-41.5%) indicated the possibility of improving harvest index and hence boosting up seed yield. The studies support the findings of Malik *et al.* (1986), Fida *et al.* (1993) and Dasgupta *et al.* (1998).

Data indicated highly significant positive correlations among 100-seed weight, biological yield, economic yield and harvest index except non-significant negative correlation between biological yield and harvest index (Table 2). These results suggest that any positive chage/increase in such traits will be helpful in boosting up the seed yield. The findings of Singh *et al.* (1997), Fida *et al.* (1993) and Khedar and Maloo (1999) get support from the present results.

Higher positive relationship between harvest index and economic yield evidently suggested that in genotypes where yield of seeds was recorded to be higher, partitioning of dry matter was relatively more in favour of seeds. These results therefore indicated that harvest index might serve as indices for identifying chickpea genotypes with higher seed yield. Thus it can be inferred from this study that genotypes having potential of high dry matter production are of no use if they do not have the potential of converting relatively large portion of it into economic yield. Importance to give due attention to harvest index while selecting chickpea varieties for commercial cultivars.

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