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Grain Yield Potential of Garden Peas (*Pisum sativum* L.) Germplasm

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Abstract: Grain yield potential in relation to other important agronomic characters of 11 vegetable pea (*P. sativum* L.) germplasm was tested during rabi 1999-2000. Germplasm PS-02 ranked first by producing maximum yield of 3167 kg ha^{-1}, while germplasm PS-10 with 3056 kg ha^{-1} ranked second. Minimum yield of 911 kg ha^{-1} was obtained by PS-07, followed by PS-11 with 1389 kg ha^{-1}. Average grain yield of group I was 45% higher than the average yield of group II. The average values of grain yield decreased in descending order from 2756 to 1513 kg ha^{-1} in group I and group II, respectively. Similarly the average values of plant height, branches per plant, dry matter yield and pods per plant decreased in descending order i.e. 137 to 89 cm, 2.5 to 2.2, 8490 to 3759 kg ha^{-1} and 11 to 7 in group I and group II, respectively and showed positive relationship with grain yield. The average values of pod length and harvest index increased in descending order i.e. 4.2 to 4.9 cm and 31.7 to 43.9 % in group I and group II, respectively. The relationship of days to maturity, seeds per pod and 100-seed weight with grain yield was not very well established. The association of harvest index with dry matter yield was significantly negative.

Key words: vegetable/garden peas, *P. sativum*, germplasm, yield and yield components

Introduction

Malnutrition one of the major problem in Pakistan is mainly due to protein deficiency in our diet. Pulses are the major and cheaper source of protein as compared to animals. The production of pulses which are high yielding, disease resistant and environmentally adaptable is the key to overcome the malnutrition problem. The development of such cultivars need an ample and diversified gene bank of pulses germplasm. In Pakistan peas are in demand as green pods and dry seeds. The crop has promising future and attempt should be made to improve yields through the development of high yielding varieties which are adapted to our climatic conditions. Keeping in view the importance of peas in Pakistan in general and NWFP in particular the present study was therefore initiated to study and compare yield and yield components, to identify the desirable traits, to maintain and conserve the selected germplasm to prevent their possible extinction, and to supply the selected germplasm to users for various research purposes.

Ishtiaq *et al.* (1996) reported significant variation in yield and yield components of peas except seeds per pod. Gupta (1990) evaluated 140 pea varieties for their reaction to powdery mildew and rust. He found that dwarf varieties were generally more susceptible to powdery mildew than tall varieties. Sarkar (1990) reported positive association of grain yield with plant height, pods per plant, harvest index and dry matter yield. Wadan (1993) reported significant variation in yield and yield components at different locations. He found that the cultivars performed well at Kalam due to cool climatic conditions compared to the climatic conditions of Mingora. Haq (1997) found positive relationship of grain yield with grains per pod and negative relationship with days to maturity and plant height.

Materials and Methods

An experiment consisted of eleven vegetable peas germplasm including six from Swat (PS-1, 4, 6, 8, 9, 10), two from North Waziristan (PS-3 and 5), and one each from Gilgit (PS-2), Dir (PS-11) and Mansehra (PS-7) was carried out during 1999-2000 growing season at the Research Farm of NWFP Agricultural University. Each germplasm was considered as treatment and planted in randomized complete block design with three replications by assigning each individual germplasm to a plot of $3m^2$. Each plot consisted of 3 rows, 2 meter long and 0.5 meter apart. Seedbed was prepared at proper vattar conditions. A basal dose of 25 kg N and 64 kg P_2O_5 per hectare was applied as DAP and incorporated into the soil during ploughing. Irrigation was applied when required. Weeds were controlled manually at the proper time.

Data were collected on days to maturity, plant height (cm), branches and pods per plant, seeds per pod, pod length (cm), 100-seed weight (g), grain yield (kg ha^{-1}), dry matter yield (kg ha^{-1}) and harvest index (%). Data were analyzed statistically and means were compared using LSD test.

Results

Statistical analysis of the data showed that days to maturity, plant height, branches per plant, dry matter yield and pod length varied significantly at 5% level of probability in different germplasm (Table 1).

Days to maturity varied significantly from 123-130 days. Average values in groups decreased in descending order from 128 in group I to 126 in group II. As these germplasm were collected from different climatic conditions, so the rate of acclimatization of a germplasm may be considered the possible cause of this variation. Similar results were reported by Wadan *et al.* (1993). Moreover, this variation could be due to the genetic variability of different germplasm. The relationship of days to matyrity with grain yield was not very well established. However, Haq *et al.*(1997) reported negative association between days to maturity and grain yield.

Plant height varied significantly from 63 cm for PS-01 to 190 cm for PS-09. Average values in groups decreased in descending order from 137 cm in group I to 89 cm in group II. As these germplasm were collected from different climatic conditions, so the rate of acclimatization of a germplasm may be considered the possible cause of this variation. Similar results were reported by Wadan *et al.* (1993). Moreover, this variation could be due to the genetic variability of different germplasm. Plant height showed positive relationship with grain yield. Sarkar (1990) reported positive but Haq *et al.* (1997) reported negative association between plant height and grain yield.

Branches per plant varied significantly from 1.7-3 in different germplasm. Average values in groups decreased from 2.5 in group I to 2.2 in group II. As these germplasm were collected from different climatic conditions, so the rate of acclimatization of a germplasm may be considered the possible cause of this variation. Similar results were reported by Wadan *et al.* (1993).

Moreover, this variation could be due to the genetic variability of different germplasm.

Table 1: Days to maturity, plant height, branches per plant, dry matter yield and pod length of garden peas germplasm

Germplasm	Days to maturity	Plant height (CM)	Branches/ plant	DM yield (kg ha^{-1})	Pod length (cm)
PS-02	125 BC	148 C	3.0 A	10560 A	4.0 B
PS-10	130 A	125 D	2.7 AB	8889 AB	4.0 B
PS-06	125 BC	90 E	2.0 BC	6889 BC	5.0 A
PS-09	130 A	190 A	2.0 BC	8889 AB	4.0 B
PS-08	129 A	132 CD	2.7 AB	7222 BC	4.0 B
Mean group 1	128	137	2.5	8490	4.2
PS-01	123 D	63 F	1.7 C	3333 E	5.0 A
PS-05	130 A	170 B	3.0 A	6111 CD	4.7 A
PS-03	125 BC	88 E	2.3 ABC	3555 E	5.0 A
PS-04	130 A	70 F	2.0 BC	3333 E	4.7 A
PS-11	124 C	70 F	1.7 C	4000 DE	5.0 A
PS-07	126 B	77 EF	2.3 ABC	2222 E	5.0 A
Mean group 2	126	89	2.2	3759	4.9
Lsd at 5%	1.171	16.837	0.756	2334.6	0.43

Mean values in the same column carrying similar letters do not differ significantly at 5% level of probability using LSD test.

Table 2: Seeds per pod, 100-seed weight, pods per plant, grain yield and harvest index of peas germplasm.

Germplasm	Seeds per pod	100-seed weight (g)	Pods/ plnt	Grain yield (KG HA^{-1})	Harvest index (%)
PS-02	3.6	17.6 BC	13 A	3167 A	30.3 CD
PS-10	3.0	18.3 B	12 AB	3056 A	25.0 D
PS-06	3.6	18.2 B	10 ABC	2778 AB	41.0 A-D
PS-09	3.6	16.1 DE	10 ABC	2444 B	28.0 D
PS-08	4.0	16.7 CD	9 BCD	2334 BC	34.2 BCD
Mean group I	3.5	17.4	11	2756	31.7
PS-01	3.6	16.3 D	6 D	1889 CD	56.7 A
PS-05	3.3	14.9 E	8 CD	1834 DE	30.3 CD
PS-03	3.6	17.6 BC	7 CD	1611 DE	45.8 ABC
PS-04	3.6	17.6 BC	8 CD	1444 DE	48.9 AB
PS-11	3.6	18.1 B	5 D	1389 EF	35.3 BCD
PS-07	3.6	20.1 A	8 CD	911 F	46.3 ABC
Mean group II	3.5	17.4	7	1513	43.9
Lsd at 5%	NS	1.110	3.891	498.730	16.516

Mean values in the same column carrying similar letters do not differ significantly at 5% level of probability using LSD test.

Branch es per plant showed positive association with grain yield.

Dry matter yield varied significantly 2222 kg ha^{-1} for PS-07 to 10560 kg ha^{-1} for PS-02. Average values in groups decreased in descending order from 8490 kg ha^{-1} in group I to 3759 kg ha^{-1} in group II. Dry matter yield showed positive relationship with branches per plant and plant height i.e. the germplasm with maximum number of branches and maximum plant height gave significantly higher dry matter yield and vice versa. As these germplasm were collected from different climatic conditions, so the rate of acclimatization of a germplasm may be considered the possible cause of this variation. Similar results were reported by Wadan *et al.* (1993). Moreover, this variation could be due to the genetic variability of different germplasm. The association of dry matter yield with grain yield was also positive. Similar results were reported by Sarkar (1990).

Pod length varied significantly from 4.0 to 5.0 cm in different germplasm. Average values in groups increased in descending order from 4.2 cm in group I to 4.9 cm in group II.

As these germplasm were collected from different climatic conditions, so the rate of acclimatization of a germplasm may be considered the possible cause of this variation. Similar results were reported by Wadan *et al.* (1993). Moreover, this variation could be due to the genetic variability of different germplasm. The association of pod length with grain yield was negative.

Statistical analysis of the data (Table 2) revealed that seeds per pod was non significant while, 100-seed weight, pods per plant, grain yield and harvest index were significantly different at 5% level of probability.

Seeds per pod varied non-significantly from 3.0 to 4.0. Average values in groups were the same i.e. 3.5 each for group I and Group II. Ishtiaq *et al.* (1996) also reported non-significant variation in seeds per pod.

100-seed weight varied significantly from 14.9 g to 20.1 g. Average values in groups were the same i.e. 17.4 g for group I and group II each. As these germplasm were collected from different climatic conditions, so the rate of acclimatization of a germplasm may be considered the possible cause of this variation. Similar results were reported by Wadan *et al.* (1993). Moreover, this variation could be due to the genetic variability of different germplasm. The association of pod length with grain yield was negative.

Pods per plant varied significantly from 5 to 14. It ranged from 9-13 in group I and 5-8 in group II. Average values in groups

decreased in descending order from 11 in group I to 7 in group II. As these germplasm were collected from different climatic conditions, so the rate of acclimatization of a germplasm may be considered the possible cause of this variation. Similar results were reported by Wadan *et al.* (1993). Moreover, this variation could be due to the genetic variability of different germplasm. The association of pod length with grain yield was negative. Pods per plant showed positive association with grain yield. Similar results were reported by Sarkar (1990).

Grain yield varied significantly from 911-3167 kg ha^{-1} in different germplasm. Germplasm PS-02 gave maximum yield, followed by germplasm PS-10, while the lowest yield was recorded for germplasm PS-07, followed by germplasm PS-11. It ranged from 2334-3167 kg ha^{-1} in group I and 911-1889 kg ha^{-1} in group II. Average values in groups decreased in descending order from 2756 kg ha^{-1} in group I to 1513 kg ha^{-1} in group II. Grain yield showed positive relationship with plant height, branches per plant, pods per plant and dry matter yield. These results are in conformity with those of Sarkar (1990). Haq *et al.* (1997) reported negative correlation between grain yield and plant height. Pod length and harvest index showed negative association with grain yield. Sarkar (1990) reported positive correlation between grain yield and harvest index. As these germplasm were collected from different climatic conditions, so the rate of acclimatization of a germplasm may also be considered the possible cause of this variation. Similar results were reported by Wadan *et al.* (1993). Moreover, this variation could be due to the genetic variability of different germplasm.

Harvest index varied significantly from 28.0 to 56.7%. Average values in groups increased in descending order from 31.7% in group I to 43.9% in group II. The relationship of harvest index with grain yield was negative. However, Sarkar (1990) reported positive correlation between grain yield and harvest index.

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