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Grain Yield Potential of Field Pea (*Pisum arvense* L.) Germplasm

Mir Hatam and Amanullah
Faculty of Crop Production Sciences,
NWFP Agricultural University, Peshawar, Pakistan

Abstract: Grain yield potential in relation to other important agronomic characters of 13 graypea (*Pisum arvense* L.) germplasm during rabbi 1999-2000 was investigated in order to identify the high yielding promising germ plasm for further studies. Germplasm GP-01 ranked first by producing maximum yield of 1000 kg/ha, while germplasm GP-12 with 944.4 kg/ha ranked second. Minimum yield of 49 kg/ha was obtained by GP-09, followed by GP-02 with 67 kg/ha. The germplasm in group I viz. GP-01 and GP-12 gave 63 and 93% higher yield than group II and group III, respectively. The higher yield in the germplasm of group I, was mainly due to more branches and pods per plant, pod length and seeds per pod and maximum dry matter than the germplasm of group II and III. GP-01 and GP-12 are the most promising germplasm recommended for further investigation.

Key words: Field pea, *Pisum arvense*, germplasm, 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 with animal source. 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 the yields through the development of high yielding varieties which are adapted to our climatic conditions.

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 that positive association of grain yield with plant height, pods per plant, harvest index and dry matter yield. Wadan *et al.* (1993) reported significant variation in the yield and yield components at different locations. He found that the cultivars performed well at Kalam due to its cool climatic conditions compared to the climatic conditions of Mingora. Haq *et al.* (1997) found positive relationship of grain yield with grains per pod and negative relationship with days to maturity and plant height.

Keeping in view the importance of peas in Pakistan in general and NWFP in particular this study was therefore, initiated to investigate 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.

Materials and Methods

An experiment consisting of 13 field pea germplasm including 8 from Swat (GP-1, 3, 6, 7, 8, 11, 12 and 13), 2 from Gilgit (GP-4 and 5), and each from Mansehra (GP-2), Dir (GP-10) and Chitral (GP-8) were carried out during 1999-2000, growing season at the Research Farm of NWFP Agricultural University, Peshawar. Each germplasm was considered as treatment and planted in Randomized Complete Block Design (RCBD) by assigning each individual germplasm to a plot of 3m². Each plot consisted of 3 rows, 2 m long and 0.5 m apart. Seedbed was prepared at proper vattar condition. A basal dose of 25 kg N and 64 kg P₂O₅ 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), dry matter yield (kg/ha) and harvest index. Data were analyzed statistically and means were compared using LSD test (Little and Hills, 1978).

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 143-167 days. Average values in groups increased

in descending order from 143 in group I to 155 in group II and then further increased to 166 days in group III. 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 maturity 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 115 cm for GP-12 and GP-13 each to 190 cm for GP-02. Average values in groups increased in descending order from 120 cm in group I to 133 cm in group II and then further increased to 163 cm in group III. Positive relationship was observed between plant height and maturity. 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 2.3-5 in different germplasm. Average values in groups decreased from 4.5 in group I to 3.5 in group III and then further decreased to 2.9 in group II. With the exception of few germplasm, the association of branches per plant with maturity and plant height was negative. Similar results were reported by Wadan *et al.* (1993).

Dry matter yield varied significantly from 3889 kg/ha for GP 05 and GP-03, 7222 kg/ha for GP-01. Average values in groups decreased from 6944 kg/ha in group I to 5740 kg/ha in group III and then further decreased to 4555 kg/ha in group II. The differences in dry matter yield were mainly affected by the number of branches per plant i.e. the germplasm with maximum number of branches per plant gave significantly higher dry matter yield and vice versa. The effect of plant height on dry matter yield was not that prominent. 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 3.0 (GP-09) to 4.3 cm (GP-12 and GP-13). Average values in groups decreased in descending order from 4.0 in group I to 3.6 in group II and then further decreased to 3.3 in group III. The association of pod length with grain yield was negative.

Statistical analysis of the data (Table 2) revealed that the means for seeds per pod, 100-seed weight, pods per plant, grain yield and harvest index were significantly different at 5% level of probability. Seeds per pod varied significantly from 2.3 (GP-03 and GP-02 each) to 5.7 (GP-12). Average values in groups decreased in descending order from 5.3 in group I to 3.7 in group II and then further decreased to 2.5 in group III. The maximum number of seeds per pod in germplasm was mainly due to longer pods with the exception of few germplasm. 100-seed weight varied significantly from 3.6 g (GP-13) to 4.9 (GP-04, GP-05). Average values in groups increased from 4.2 g in group I to 4.4 g in group II and III each. Pods per plant varied significantly from 2 (GP-03, 07, 02 and 09 each) to 20 (GP-01). It ranged from 17-20 in group I, 2-8 in group II and 2 each for each germplasm of

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

Germplasm	Days to maturity	Plant height (cm)	Branches/ plant	DM yield (kg/ha)	Pod length(cm)
GP-01	143.0C	125.0E	5.0A	7222.0A	3.7B
GP-12	143.0C	115.0F	4.0B	6667.0A	4.3A
Mean	143.0	120.0	4.5	6944.0	4.0
group 1					
GP-13	144.0C	115.0F	3.0C	4444.0BC	4.3A
GP-04	143.0C	138.0D	4.3AB	6111.0AB	3.7B
GP-05	157.0B	143.0CD	2.3C	3889.0C	3.3BC
GP-10	167.0A	145.0BCD	2.3C	4444.0BC	3.3BC
GP-03	166.0A	127.0E	3.0C	3889.0C	3.7B
Mean	155.0	133.0	2.9	4555.0	3.6
group 2					
GP-07	166.0A	152.0B	4.3AB	6111.0AB	3.7B
GP-02	167.0A	190.0A	4.0B	6667.0A	3.3BC
GP-09	166.0A	147.0BC	2.3C	4444.0BC	3.0C
Mean	166.0	163.0	3.5	5740.0	3.3
group 3					
LSD 5%	002.116	008.204	0.910	2029.0	0.644

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

Germplasm	Seeds/ pod	100-seed weight (g)	Pods/ plant	Grain yield (kg/ha)	Harvest index
GP-01	5.0A	4.2C	20.0A	1000.0A	14.0A
GP-12	5.7A	4.2C	17.0A	944.0A	14.1A
Mean	5.3	4.2	18.5	972.0	14.0
group 1					
GP-13	5.0A	3.6D	8.0BC	578.0	13.8A
GP-04	3.7B	4.9A	7.0BC	389.0C	7.2B
GP-05	4.0B	4.9A	7.0BC	300.0C	7.8B
GP-10	3.7B	4.0C	3.0CD	266.0C	6.2B
GP-03	2.3C	4.8AB	2.0D	250.0C	6.9B
Mean	3.7	4.4	5.4	356.0	8.4
group 2					
GP-07	2.7C	4.0C	2.0D	83.0D	1.3C
GP-02	2.3C	4.7AB	2.0D	67.0D	1.0C
GP-09	2.7C	4.5B	2.0D	49.0D	1.1C
Mean	2.5	4.4	2.2	66.0	1.1
group 3					
LSD 5%	0.815	0.237	4.491	160.052	4.710

group III. Average values in groups decreased in descending order from 18.5 in group I to 5.4 in group III and then further decreased to 2.2 in group III. Grain yield varied significantly from 49 to 1000 kg/ha in different germplasm. Germplasm GP-01 gave maximum yield (1000 kg/ha), followed by germplasm GP-12 (944 kg/ha), while the lowest yield was recorded for germplasm GP-09 (49 kg/ha). It ranged from 944-1000 kg/ha in group I, 250-578 kg/ha in group II and 49-83 kg/ha in group III. Average values in groups decreased in descending order from 972 kg/ha in group I to 356 kg/ha in group III and then further decreased to 66 kg/ha in group III. Grain yield showed positive relationship with pod length, seeds per pod and pods per plant, while negative association was established with days to maturity and plant height. Harvest index varied significantly from 1.0 (GP-02) to 14.1% (GP-12). Average values in groups decreased in descending order from 14.0% in group I to 8.4% in group II and then further decreased to 1.1% in group III. The relationship of harvest index with grain yield was significantly positive.

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