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PERFORMANCE OF NINE PEA CULTIVARS UNDER FAISALABAD CONDITIONS

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The study was conducted to evaluate the performance of nine pea cultivars i.e. AM-I, Samrina Zard, 226-Y/B, P-48. Olympia, P-42. Meteor, Knight and P-I under Faisalabad conditions. Many quantitative characteristics such as seed germination. plant height at the time of first flowering, final plant height, number of leaves per plant, number of days taken to first flowering. number of pods per plant, pod length, green pod weight, number of seeds per pod, green pod yield and crop duration were studied. All the parameters appeared to be purely genetic characters, because the cultivars possessed highly significant difference among them, except seed germination, which depends upon physiological age of seed at harvesting and subsequent handling, and crop duration which was significant on account of other quantitative characters. The cultivars Knight, Meteor and Samrina lard followed by Olympia were found high yielding as compared to other cultivars because of their ability to produce the higher green pod yields, while the performance of AM-I and P-48 was poorer on the same account..

Key words: green pod yield. pea cultivars. *Pisum sativum,* vegetative growth

INTRODUCTION

Pea (*Pisum sativum* L.) is one of the prominent winter vegetables grown in Pakistan. It is the richest source of protein i.e. 6-70,0 in green peas (on fresh weight basis) and 18-35 % in dry seeds. It is a good source of vitamins A, B and C and also contains a high proportion of minerals (Khvostova, 1983). In Pakistan, it is cultivated on an area of 10 thousand hectares with a total production of 72 thousand metric tons (Anonymous, 1999). Average green pod yield of peas in Pakistan is quite low (7.2 t/ha) as compared to that of several other countries.

Agricultural scientists are trying their best to increase the agricultural productivity in the country. Three possible strategies to achieve the goal include: expansion of agricultural land. increasing the cropped area and per unit area productivity. Land as a whole is a limited resource and in a country like Pakistan where there is a high rate of urbanization. it is very difficult to increase the agricultural land. Similarly. the increase in cropped area is not an easy task because of the economic condition of the farmers. Under such conditions, increase in per unit area productivity is the only option. which demands many things such as improved cultivars. high inputs, efficient cultural practices etc. Our farmers cannot afford high inputs in terms of more fertilizer and/or pesticide application. Therefore, the only alternative is to evolve high yielding cultivars and their adaptability to local conditions to increase yield per unit area. Ashraf et al. (1981) analysed partial correlation in eight pea cultivars and found that days to first picking and pod and seed weight per plant were positively and significantly correlated. Dantuma (1983) described the method for calculation of yield potential through growth rates, duration of growth period and harvest index. Gent (1976) made three years trial on 11 pea cultivars and found that cv. Ceb-201 was high yielding. Randhawa (1984) made recommendations for the cultivation of new early maturing and high yielding peas cv. Arkel.. Cervato et al. (1984) tested nine commercial cultivars and new lines for early maturity, yield and flexibility in harvesting dates. They observed that new lines 133 and 145 appeared promising. Schmelez (1985) conducted trials over three seasons with eight Hungarian pea cultivars and found that Aurora was the earliest cultivar (69 days from sowing to harvesting) and Debreceni Sotet Gyongy the latest (79 days). Rastogi and Singh (1988) studied pod size, number of seeds/pod, number of pods/plant and seed ascorbic acid contents in 10 pea cultivars during 1982-84. Cv. Kinnauri gave the highest yield followed by cv. Lincoln compared with other cultivars. It is evident from the studies reported above that the pea cultivars differ in their yield potential and adaptability to various climatic conditions, hence there seemed a need to conduct trials under local conditions. Thus, in the present study, nine cultivars of pea were compared to evaluate their performance to make it easier for the farmers to select cultivars of their choice.

MATERIALS AND METHODS

The present study was conducted at the Experimental Vegetable Research Area, Department of Horticulture. University of Agriculture, Faisalabad, during the year 1997-98 to study the performance of nine pea cultivars. Certified seeds of these cultivars i.e. AM-], Samrina lard, 226-Y*IB, p-48,* Olympia, P-42, Meteor, Knight and P-I were obtained from the Ayub Agricultural Research Institute, Faisalabad. The crop was planted on October 22, 1997 on well-prepared beds. Seeds were sown on both sides of the raised beds measuring 300 x]00 cm². Bed to bed and plant to plant distance was maintained at 100 and 10-12 cm. respectively. First irrigation was applied just after the sowing of seed. taking care to avoid overflooding. Subsequent irrigations were applied at an interval of 7 - 15 days according to the need of the crop. The cropwas fertilized normally and hoed twice manually to keep it free from weeds. During the entire growing period of the crop, no pesticide was sprayed because there was no incidence of any insect-pest or disease attack.

After three weeks of seed germination, twenty plants were tagged randomly for each variety and the following observations were recorded: plant height at the time of flowering, final plant height, number of leaves per plant, number of days taken to first flowering, number of pods per plant, pod length, weight per green pod, number of seeds per pod, green pod yield and crop duration. The experiment was laid out in accordance with randomised complete block design in four replications. All the experimental data were analysed using "MST AT" statistical package (Anonymous, 1986). The cultivar means were subjected to Duncan's multiple range test at 5 % level of probability for comparison of their significance.

RESULTS AND DISCUSSION

Seed Germination: It is evident from the results that the cultivars differed significantly for seed germination percentage. The cultivars 226-Y*IB* and P-I stood at par having the maximum germination percentage of 89.06 and 86.00 respectively. The seeds of P-42 and Knight showed poor germination percentage (49.25 and 46.94 respectively), the lowest of all other cultivars. These two cultivars also behaved statistically alike. All other cultivars were intermediate between these cultivars (Table I). Seed germination and seedling vigour are affected by physiological age of the seed at harvest and subsequent handling (Muehlbauer and McPhee, 1997). The seeds collected 28 days after anthesis attained complete viability (Manohar and Sachan, 1974). If the seed is harvested earlier than the proper maturity stage, it may result in its reduced viability or in other words, younger the seed at harvest, lower will be the viability. Besides harvesting time, harvesting and threshing methods and storage conditions also affect the seed viability (Castillo et aI., 1992).

Plant Height at the Time of First Flowering: Data recorded on plant height at the time of first flowering. indicated significant differences among the cultivars. Maximuim plant height at flowering (32.72 cm) was recorded in the plants of P-I, while the minimum (14.63 cm) in Olympia. All other cultivars were 'intermediate between these two limits (Table I). It is interesting to note the huge difference between the minimum and the maximum plant height at the time of flowering (i.e. 14.63 to 32.72 cm). The difference in plant height might be due to the genetic make up of these cultivars. The cultivars with minimum height at flowering are considered as not only dwarf but also early flowering.

Final Plant Height: Relevant data indicated significant differences among the cultivars. Comparison of cultivar means reveals that the maximum final height (60.45 cm) was attained by the plants of P-I followed by those of *226-Y/B* (54.47 cm), while the minimum was recorded in Olympia (40.75 cm) (Table I). These results are almost similar to those recorded at the time of first flowering. During vegetative growth, pea stems develop 20 to 25 nodes, which in turn determine the height of plants. The number of nodes is primarily dependent on the cultivar used (Muehlbauer and McPhee. 1997). As the final height of the plants varied among the cultivars, therefore, it may be stated that the final height is a genetic character. In an earlier study, Gentry (1971) also reported differences in plant height among different pea cultivars.

Number of Leaves per Plant: Highly significant differences were observed in this respect among the cultivars. It is clear from the data that Meteor possessed the highest number of leaves (77.66), closely followed by P_I, *226-Y/B* and Samrina Zard. These cultivars exhibited the maximum vegetative growth. Olympia had the minimum number of leaves (59.65) (Table I). It is evident that the tall cultivars possessed comparatively more number of leaves than the dwarf ones. It appears that the cultivar Olympia can provide an earlier crop than other cultivars since the minimum vegetative growth leads to an early reproductive growth. Vegetative growth of pea plant is affected by both genetic and environmental factors, which interact with each other to further modify plant growth. The genetic effects include photosynthetic potential, water use efficiency, plant growth rate, leaf area index and seed size etc. The genetic factors are influenced by environmental conditions including plant density and climatic conditions (Muehlbauer and McPhee, 1997). Hence, variation in pea cultivars could be due to their genetic make up and adaptability to prevailing environmental conditions.

Number of Days to First Flowering: The time taken from germination to flower initiation revealed significant differences among the cultivars. It is evident from Table 1 that Samrina Zard took the maximum days (58.38) to first flowering closely followed by 226-Y*IB* (58.13 days) and P-48 (57.25 days), whereas P-42, Olympia, Meteor and AM-I took the minimum number of days to start flowering (53.69 to 54.63). The cultivars taking minimum number of days to flowering are comparatively early maturing than other cultivars, From the farmers point of view such cultivars seem more desirable because early flowering means early crop maturity. The cultivars Samrina Zard, 226-Y*IB* and P-48 stood at par while AM-I, Meteor, Olympia and P-42 also behaved statistically alike. According to Makasheva (1983), pea cultivars have a sufficiently wide range of duration of vegetative period and their consequent phases (flowering, maturation etc.). The duration of vegetative period corresponds to agro-climatic peculiarities of the area of their cultivation.

Number of Pods per Plant: Data concerning number of pods per plant indicated significant difference among the cultivars. However, all the cultivars except 226-Y*18* produced nearly the same number of pods per plant. The cultivar 226-Y*IB* and AM-I produced the minimum number of pods per plant and also stood at par with each other (Table I). It indicated that priority could be given to a certain cultivar over others on the basis 'of number of pods per plant, if other parameters were also at optimum level.

Pod Length: Data on pod length showed significant differences among the cultivars. A comparison of means for cultivars indicated that Knight exhibited the maximum pod length (8.05 cm) followed by Olympia (7.76 cm) and statistically it remained at par with Knight. The

Table 1. [illegible]

Characters	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Seed germination (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Plant height at flowering (cm)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Number of [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Number of days to flower	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Number of nodes/plant	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pod length (cm)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Number of seeds/pod	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Green pod yield/plant (g)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Green pod yield (t/ha)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Crop duration (days)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* [illegible]

minimum pod length (6.28 cm) was recorded in Meteor (Table I). A number of earlier workers have already reported that pea cultivars vary greatly in size and shape of pods and number of seeds per pod (Gentry, 1971; Makasheva, 1983; Muehlbauer and McPhee, 1997).

Weight per Green Pod: The data showed that the cultivars had significant difference among their means for green pod weight. The cultivar 226-Y/B had the maximum green pod weight (4.59 g). The cultivars Knight, Meteor: Samrina lard, P-I and Olympia tended to stand at par with 226-Y/8. The poorest performance was shown by the cultivars P-48, AM-I and P-42, having only 3.51, 3.69 and 4.00 g of green pod weight respectively (Table I). This variation might be due to the inherent potential of cultivars and their interaction with climatic conditions.

Number of Seeds per Pod: Relevant data indicated that significant differences existed among the cultivars. Comparison of cultivar means revealed that the cultivar Knight produced the maximum number of seeds per pod (6.16) followed by P-I, Meteor and Olympia, whereas the cultivar 226-Y/B produced the lowest number of seeds per pod (4.91). which also stood at par with P-48, AM-I, Samrina *lard* and P-42 (Table I). These results showed that the cultivar 226 Y/B is a poor variety to produce adequate number of seeds per pod. According to Makasheva (1983), the number of seeds in a pod is variable depending upon the cultivar.

Green Pod Yield: It is clear from the data that the cultivars had significant differences for the parameter under study. Maximum green pod yield per plant was obtained from the cultivars Knight (108.64 g), Meteor (105.00 g) and Samrina *lard* (100,43 g). All these cultivars behaved statistically alike. Minimum green pod yield per plant was obtained from the cultivars AM-I (79.25 g) and P-48 (83.00 g). Both these cultivars also stood at par with each other (Table I). Since green pod yield per hectare was calculated on the basis of yield per plant and number of plants per hectare, therefore, it followed the same pattern of significance as the green pod yield per plant. Yield is a complex character determined by the interaction of many heritable characters with soil, climate and agronomic conditions (Makasheva, 1983). Maximum yield requires maximum vegetative growth during crop establishment (Muehlbauer and McPhee, 1997). Higher number of leaves means more photosynthesis and ultimately more yield. In the present study, the cultivars Meteor and Samrina *lard* had more number of leaves and thus resulted in higher yields. It is, however, strange that Knight with lower number of leaves also resulted in higher yield, which might be due to the inherent yield potential of the cultivar.

Crop Duration: Pertinent data indicated significant differences in this respect among the cultivars. A comparison of cultivar means showed that Meteor exhibited the longest duration of 162.38 days. It is of course interesting that the other four cultivars i.e. 226-Y/B, Knight, P-I and P-42 also stood at par with Meteor in terms of crop duration. The minimum crop duration (155.25 days) was recorded in AM-I and Samrina Zard followed by Olympia (157.81 days). P-48 (157.94 days) and P-42 (158.38 days). These cultivars also behaved statistically alike (Table I).

Apparently, no relation seems between days taken to flowering and crop duration, which probably indicates that early flowering cultivars do not necessarily be having short crop duration. Actually crop duration depends upon several factors including adaptability of a cultivar to prevailing environmental conditions and its continued vegetative growth. Gentry (1971) has already identified more than 1000 cultivars of pea varying in different quantitative characters including maturity periods.

REFERENCES

Anonymous. 1986. "MSTAT" Micro-Computer Statistical Programme. Michigan State. Univ., East Lansing, Michigan, USA.

Anonymous. 1999. FAO Production Year Book. 1998. FAO, Rome, Italy.

Ashraf, M., M.M. Shafi and S.N. Ahmad. 1981, Correlation studies on certain morphological and economic characteristics in eight cultivars of peas. 1, Agri. Res. 19: 175-180.

Castillo, A.G., 1.G. Hampton and P. Coolbear. 1992. Effect of time and method of harvest on seed vigour in garden peas *(Pisum sativum* L.). J. Appl. Seed Prod. 10: 31-36.

Cervato, A., P. Ramalli and D. Ceci. 1984. Harvesting dates, yield and quality. Informatore Agrario, 40: 35-38 [Hort. Abst. 55(7): 5318, 1985].

Dantuma, G. 1983. Potential and Actual Yields of Dried Peas in North Western Europe: Perspectives for Peas and Lupins as Protein Crops. Martinus Nijhoff Publishers, Dordrecht, Netherlands. 165-168.

Gent, G. 1976. Pick of the dried peas. Arable Farming, 3: 56-59.

Gentry, H.S. 1971. *Pisum* resources: A preliminary survey. Plant Genet. Res. Newsletter, 25: 3-13.

Khvostova, V.V. 1983. Breeding and Genetics of Peas. Oxonian Press Pvt. Ltd., New Delhi, India.

Makasheva, R.Kh. 1983. The Pea. Oxonian Press Pvt. Ltd., New Delhi, India. 78-107.

Manohar, M.S. and S.c.P. Sachan. 1974. Pod development and germination studies on pea *(Pisum sativum* L.). Vegetable Sci. I: 22-30.

Muehlbauer, E.J. and K.E. McPhee. 1997. Peas. In The Physiology of Vegetable Crops (Ed. H.C. Wein). CAB International, Wallingford, UK. 429-459.

Randhawa, K.S. 1984. Improved technology for higher pea seed production. Seeds and *Farms,* 10: 13-18.

Rastogi, K.B. and K.K. Singh. 1988. Seed production studies in pea cultivars in mid hill conditions of Himachal Pradesh. Seeds and Farms, 14: 47-49.

Schmelez, L. 1985. Certified cultivars: Green peas. Kerteszet es Szyleszet, 34: 5-6 [Field Crop Abst. 39(1): 563, 1986].