

# Performance of Garden Pea Genotypes at High Hills of Nepal

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## Abstract

Eleven Garden pea genotypes viz. DGP 01, DGP 02, DGP 03, DGP 04, DGP 05, DGP 06, DGP 07, DGP 08, DGP 09, DGP 10 and Arkel, a check variety, were evaluated for selection of suitable high yielding genotypes for Jumla, a high hill district of mid-western region of Nepal during 2014 and 2015. The study was conducted at Horticulture Research Station, Rajikot, Jumla by using randomized complete block design with 3 replications. The highest average fresh pod yield (10.08 t/ha) was observed in DGP 09 followed by DGP 01 (9.55 t/ha) and DGP 03 (9.53 t/ha). Organoleptic evaluation showed that the pods of DGP 03 and DGP 09 had acceptable quality in taste. Based on the results, genotypes DGP-09 and DGP-03 were found to be good in vegetative, organoleptic as well as yield component characters. So, these genotypes can be recommended for commercial production in Karnali zone of Nepal.

**Keywords:** Fresh pod, Garden pea, Yield

## Introduction

Pea (*Pisum sativum* L.) belonging to family Leguminosaeae is an important leguminous crop. Peas are very common nutritious vegetable grown in cool season throughout the world (Pandita and Pratap, 1986). In Nepal, it is an important vegetable as well as pulse crop. It is one of the richest sources of protein (18-35 % in dry seeds). In Nepal, green peas are widely grown in terai in winter but in summer in hills (Ghale *et al.* 2004; Poon *et al.* 2004).

Peas are cultivated for the fresh green seeds, tender green pods, dried seeds and foliage too. The nutritional composition of pea crop in 100 g of edible portion is moisture – 72%, Calories- 93, Carbohydrate - 15.9%, Thiamine- 0.25mg, Riboflavin- 9mg, Protein- 7.2%, Fat- 0.1 g, Calcium- 20 mg, B carotene-83mg, Iron-1.5mg (Pun and Karmacharya, 1988). It is a good source of vitamins A, B and C and also contains a high proportion of minerals (Khvostova, 1983). Green peas are eaten cooked as a vegetable, and are marketed fresh, canned, or frozen while ripe dried peas are used whole, split, or made into flour. Pulses are important food crops for the food security of large proportions of populations, particularly in Latin America, Africa and Asia, where pulses are part of traditional diets and often grown by small farmers (FAO, 2016). It is favorite with almost everyone and is always in great demand round the year and it is excellent food for human consumption. It can tolerate frost and freezing during its vegetative growth but frost is harmful to flower and pod (Pun and Karmacharya, 1988).

The productivity of pea in Nepal is very low. The consumption rate of pea in Nepal is estimated at 360 g and 70 g per capita per annum in the urban and rural areas, respectively (Shah, 2004). In Nepal, the cultivated area of pea is estimated to be 6520 ha with total production of 63489 tons and productivity 9.74 t/ha (ABPSD, 2014). In Karnali region pea growing area is 19 ha with green pod production of 125 metric tons with productivity 6.58 mt/ha (ABPSD, 2015). This indicates that average green pod yield of peas in Karnali region is very low as compared to the national productivity.

There is no one variety recommended in Karnali region for commercial cultivation. It is fact that all cultivars do not perform equally well in all areas. It is essential to know the performance of cultivars in a specific area. The variety selection is one of the best options for productivity increment in pea.

To minimize the import of pea from outside, there is a big scope for increasing the yield through adoption of suitable high yielding varieties. Therefore, this study was conducted to select high yielding and consumer /farmer preferred pea genotypes suitable for mid-western high hill of Nepal.

## Materials and Methods

Eleven different promising garden pea genotypes viz. DGP 01, DGP 02, DGP 03, DGP 04, DGP 05, DGP 06, DGP 07, DGP 08, DGP 09, DGP 10 and Arkel (a released improved variety used as check) were tested at the research station, Rajkot (altitude: 2300 masl, latitude: 28°58' to 29°30' North and longitude: 81°18' to 82°18' East) in Randomized Complete Block Design (RCBD) with three replications during 2014 and 2016 under Coordinated Varietal Trial (CVT). Being an organic district, the plots were fertilized with 20 ton compost/ha. Seed sowing (breeder seed) was done in the last week of Falgun at crop geometry of 50 cm x 10 cm. Individual plot size was 3.6 m<sup>2</sup> (2m x 1.8m). The necessary data for growth (number of germinated seeds per plot, plant height), yield and yield parameters (days to first fresh pod harvest, number of pods per plant, numbers of seeds per pod, length of pod and fresh pod yield) were collected and analyzed. The data was analyzed by MSTATC.

## Result and Discussion

### Vegetative Parameters

Plant height, days to 50% flowering, position of the first flower, days to first and last fresh pod harvest, number of seeds per pod, length of pod, fresh pod yield, hundred green seed weight, organoleptic evaluation and shelling percentage were found significant among each other.

Maximum germination (90.04%) was observed in genotype DGP 09 followed by DGP 03 (81.71%) whereas the minimum (57.64%) was in DGP 04. The tallest plants (72.58 cm) were measured in DGP 09 followed by DGP 03 (65.58 cm) and the dwarfest (40.22 cm) was in Arkel. Days to 50 % flowering was early (68.5 days after sowing i.e. DAS) in DGP 10 followed by DGP 02 (69.5 DAS) and DGP 06 (69.5 DAS) whereas DGP 03 was latest (74.67 DAS) in flowering (Table 1).

**Table 1.** Vegetative and Reproductive characters of garden pea genotypes evaluated at HRS, Rajikot, Jumla during 2014 and 2016

Treatments	Germination (%)			Plant Height (cm)			Days to 50 % flower		
	2014	2016	Mean	2014	2016	Mean	2014	2016	Mean
DGP 01	74.54 abc	82.87 ab	78.71 abc	51.53 d	54.03 d	52.78 d	74.00 c	72.00 b	73.00 b
DGP 02	65.28 bcd	73.15 bc	69.21 bcde	54.27 cd	56.77 cd	55.52 cd	70.00 f	69.00 cd	69.50 e
DGP 03	79.63 ab	83.80 ab	81.71 ab	64.33 b	66.83 b	65.58 b	75.00 b	74.33 a	74.67 a
DGP 04	51.39 de	63.89 c	57.64 e	56.83 c	59.33 c	58.08 c	71.00 e	70.00 c	70.50 cd
DGP 05	75.46 abc	78.24 bc	76.85 abc	53.67 cd	56.17 cd	54.92 cd	72.00 d	69.67 cd	70.83 cd
DGP 06	62.50 cde	71.30 bc	66.90 cde	54.53 cd	57.03 cd	55.78 cd	70.00 f	69.00 cd	69.50 e
DGP 07	70.83 abc	75.93 bc	73.38 bcd	52.20 d	54.70 d	53.45 d	71.00 e	69.00 cd	70.00 de
DGP 08	76.39 abc	73.61 bc	75.00 bcd	53 cd	55.50 cd	54.25 cd	72.00 d	70.67 bc	71.33 c
DGP 09	83.33 a	96.76 a	90.04 a	71.33 a	73.83 a	72.58 a	75.33 a	70.00 c	72.67 b
DGP 10	79.17 ab	81.94 b	80.56 abc	51.40 d	53.90 d	52.65 d	69.00 g	68.00 d	68.50 f
Arkel	49.54 e	72.69 bc	61.11 de	39.63 3	40.80 e	40.22 e	71.00 e	69.00 cd	70.00 de
F Test	**	**	**	**	**	**	**	**	**
CV (%)	12.20	10.35	10.20	4.10	3.70	3.90	0.20	1.31	0.83
LSD (0.05)	14.49	13.70	12.87	3.85	3.64	3.71	0.30	1.56	0.70

\*\* , Significant at  $P \leq 0.01$ . LSD, Least Significant Difference. CV, Coefficient of Variance

## Reproductive Parameters

Position of first flower ranged from 5<sup>th</sup> to 10<sup>th</sup> node among the genotypes. The first flower position of Arkel appeared on 5<sup>th</sup> node whereas it appeared on 10<sup>th</sup> node in DGP03 and DGP09 and the difference was statistically significant. Days to first fresh pod harvest was earliest (77 DAS) in genotype DGP 06 followed by Arkel (78 DAS) and DGP 02, DGP 04, DGP 05, DGP 08 (79 DAS) whereas the first fresh pod harvesting was late in DGP 09 (82.83 DAS) and DGP 03 (85.5 DAS). Similarly, days to last fresh pod harvest was early (92.5 DAS) in DGP 05 followed by DGP 06 and Arkel (93.5 DAS) whereas the highest number of days to last fresh pod harvest ( 98.5 days) was recorded in DGP 03 and DGP 09 (Table 2).

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**Table 2.** Reproductive and yield characters of garden pea genotypes evaluated at HRS, Rajikot, Jumla during 2014 and 2016

Treatments	Position of first flower			Days to first fresh pod harvest			Days to last fresh pod harvest		
	2014	2016	Mean	2014	2016	Mean	2014	2016	Mean
DGP 01	8.87 cd	8.80 abc	8.83 b	82.67 b	81.67	82.17	95.00 d	96.00 abc	95.50 be
DGP 02	8.23 de	8.40 abcd	8.32 bcd	80.00 c	78.00	79.00	98.00 b	97.00 ab	97.50 ab
DGP 03	10.30 a	9.33 ab	9.82 a	85.00 a	86.00	85.50	98.33 ab	98.00 a	98.50 a
DGP 04	6.33 f	6.67 e	6.50 f	80.00 c	78.00	79.00	95.00 d	94.00 abc	94.50 efg
DGP 05	7.80 e	7.23 de	7.52 ce	80.00 c	78.00	79.00	93.00 f	92.00 c	92.50 g
DGP 06	7.87 e	7.67 cde	7.77 cde	78.00 d	76.00	77.00	94.00 e	93.00 bc	93.50 eg
DGP 07	8.37 cde	8.27 bcd	8.32 bcd	80.00 c	78.33	79.17	98.00 b	97.00 ab	97.50 abc
DGP 08	9.13 bc	9.00 ab	9.07 ab	80.00 c	78.00	79.00	98.00 b	97.00 ab	97.50 abcd
DGP 09	9.80 ab	9.57 a	9.68 a	84.67 a	81.00	82.83	98.67 a	98.00 a	98.50 a
DGP 10	8.80 cd	8.43 abcd	8.62 b	80.00 c	78.00	79.00	96.00 c	95.00 abc	95.50 bcef
Arkel	4.33 g	5.53 f	4.93 g	79.00 cd	77.00	78.00	94.00 e	93.00 bc	93.50 efg
F Test	**	**	**	**	ns	ns	**	*	**
CV (%)	5.80	7.97	5.50	0.90	8.57	4.30	0.20	2.28	1.86
LSD (0.05)	0.81	1.09	0.76	1.71			0.41	3.71	1.10

\*, Significant at  $P \leq 0.05$ . \*\*,  $P \leq 0.01$ . LSD, Least Significant Difference. CV, Coefficient of Variance

## Pod Characteristics

Number of pods per plant ranged from 13 to 16. Though it was found non significant among each other, comparatively the highest number of pods (16) were counted in DGP 09 and Arkel and the least (13) in DGP 10. Number of seeds per pod was the highest (8) in DGP 09 and DGP 03 (8) whereas the lowest number (5) was in DGP 06. The longest pod length (8.99 cm) were recorded in DGP 09 followed by DGP 03 (8.80 cm) and the shortest pod length (6.16 cm) in DGP 06 (Table 3).

**Table 3.** Pod characters of garden pea genotypes at HRS, Rajikot, Jumla during 2014 and 2016

Treatments	No. of pods per plant			No. of seeds per pod			Length of pods (cm)		
	2014	2016	Mean	2014	2016	Mean	2014	2016	Mean
DGP 01	14.40	14.07	14.23	7.42 a	7.42 bc	7.42 ab	8.99 ab	7.86 bc	8.43 bc
DGP 02	14.33	13.00	13.67	7.00a	6.00 ab	6.52 bc	7.97 de	7.91 bc	7.94 d
DGP 03	14.57	14.57	14.57	7.22 a	8.13 ab	7.68 a	9.25 a	8.35 ab	8.80 ab
DGP 04	15.5	15.60	15.55	5.57 bc	5.33 e	5.45 de	7.13 f	6.33 f	6.73 g
DGP 05	13.33	15.90	14.62	6.40 b	6.17 de	6.28 cd	7.57 ef	6.58 ef	7.08 fg
DGP 06	14.07	15.53	14.80	5.10 c	5.43 e	5.27 e	5.85 g	6.48 ef	6.16 h
DGP 07	13.60	13.60	13.60	6.43 ab	6.47 cd	6.45 bcd	7.66 e	7.11 de	7.38 ef
DGP 08	11.53	14.53	13.03	6.43 ab	6.77 cd	6.60 bc	8.57 bc	7.57 cd	8.07 cd
DGP 09	12.90	19.13	16.02	7.01 a	8.47 a	7.74 a	8.93 ab	9.03 a	8.99 a
DGP 10	12.63	12.90	12.77	6.68 ab	6.77 cd	6.73 abc	8.17 cd	7.32 cd	7.75 de
Arkel	14.90	17.30	16.10	6.23 abc	6.52 cd	6.38 bcd	7.62 e	6.57 ef	7.09 fg
F Test	ns	ns	ns	*	**	**	**	**	**
CV (%)	29.30	19.65	21.00	10.50	8.06	8.50	3.40	5.53	3.40
LSD (0.05)				1.62	0.91	0.96	0.46	0.69	0.45

\*, Significant at  $P \leq 0.05$ . \*\*,  $P \leq 0.01$ . LSD, Least Significant Difference. CV, Coefficient of Variance

## Pod Yield

Fresh pod yield differed significantly among the genotypes (Table 4). The highest pod yield (10.08 t/ha) was recorded in DGP-09 but it was statistically similar with DGP-01 (9.55 t/ha), DGP-03 (9.53 t/ha), DGP-02 (6.86 t/ha) and DGP-07 (6.37 t/ha). But the lowest yield (3.85 t/ha) was given by DGP 06.

Weight of hundred green seed was the highest (47.33 g) in DGP 09 followed by DGP 03 (46.83 g) and the lowest (31.17 g) in DGP 06. Based on the result of organoleptic evaluation, Arkel was found the best in quality (8.27) i.e. tasty followed by DGP 06 (8.17), DGP 03 (7.5) and DGP 09 (7) whereas DGP 02 was found with the lowest organoleptic value (1.67). The highest shelling percentage was found in DGP 04 (57.75%) followed by DGP 10 (53.96%) and DGP 08 (53.03%) and the lowest (49.83%) in DGP 06 (Table 4).

**Table 4.** Pod yield, organoleptic evaluation and shelling percentage of garden pea genotypes at HRS, Rajikot, Jumla during 2014 and 2016

Treatments	Fresh pod yield (t/ha)			100 green seed weight (g)			Organoleptic evaluation			Shelling %		
	2014	2016	Mean	2014	2016	Mean	2014	2016	Mean	2014	2016	Mean
DGP 01	10.83 a	8.26	9.55 ab	45.33 a	44.33 b	44.83 ab	2.00 g	3.33 c	2.67 fg	53.73	52.79	53.26
DGP 02	6.21 ab	7.52	6.86 abc	35.67 c	35.00 c	35.33 d	1.33 h	2.00 c	1.67 g	52.44	49.77	51.11
DGP 03	10.72 a	8.34	9.53 ab	42.67 ab	51.00 a	46.83 a	7.00 b	8.00 a	7.50 ab	50.84	51.49	51.17
DGP 04	4.21 b	4.44	4.33 c	42.67 ab	41.33 b	42.00 bc	3.00 f	4.00 c	3.50 ef	58.41	57.09	57.75
DGP 05	4.44 b	5.80	5.12 c	41.33 ab	40.33 b	40.83 c	4.00 e	3.00 c	3.50 ef	52.16	49.46	50.81
DGP 06	3.63 b	4.07	3.85 c	29.00 d	33.33 c	31.17 e	8.00 a	7.33 ab	8.17 a	50.77	48.89	49.83
DGP 07	6.34 ab	6.41	6.37 abc	39.67 bc	41.00 b	40.33 c	6.00 c	7.33 ab	6.67 bc	53.23	51.05	52.14
DGP 08	6.50 ab	5.54	6.02 bc	39.00 bc	41.00 b	40.00 c	6.00 c	5.00 bc	5.50 c	54.73	51.32	53.03
DGP 09	10.30 a	9.86	10.08 a	41.67 ab	53.00 a	47.33 a	6.00 c	8.00 a	7.00 ab	48.69	53.25	50.97
DGP 10	5.59 ab	5.52	5.55 c	41.00 ab	41.33 b	41.17 c	5.00 d	4.67 bc	4.83 de	58.11	49.81	53.96
Arkel	4.67 b	3.94	4.30 c	40.33 b	41.33 b	40.83 c	8.33 a	8.53 a	8.27 a	52.91	46.84	49.88
F Test	*	ns	*	**	**	**	**	**	**	ns	ns	ns
CV (%)	41.10	40.52	31.70	6.30	5.80	5.00	6.90	28.35	14.70	8.80	9.69	7.46
LSD (0.05)	4.68		3.51	4.24	4.18	3.46	0.61	2.69	1.35			

\*, Significant at  $P \leq 0.05$ . \*\*,  $P \leq 0.01$ . LSD, Least Significant Difference. CV, Coefficient of Variance



## Discussion

Variations observed in vegetative as well as yield parameters show the wide genetic diversity among the genotypes. The position of first flower ranged from 4.93 to 9.82 based on average data. Similar trend was also reported by Poudel *et al.*, (2017) and Poon *et al.*, (2004). Days to 50 % flowering ranged from 68.5 to 74.67 days after sowing whereas findings of Poudel showed the range from 40.17 to 58.67 days after sowing. Days to first fresh pod harvest differed with the result of Poudel *et al.*, 2017. Likewise, the number of pods per plant (12.77 to 16.1) differed from the finding of Poudel *et al.*, 2017. But, the number of seeds per pod (5.27 to 7.74) and length of pods (6.16 to 8.99) of tested genotypes were in the line with the results of Ghale *et al.*, (2004) and Choudhary and Sharma (2004).

Hundred green seed weight was the highest (47.33 gm) in DGP 09 followed by DGP 03 (46.83 gm). This was similar to the findings of Poudel *et al.* (2017). The highest fresh pod yield (10.08 t/ha) was found in DGP 09 followed by DGP 01 (9.55 t/ha) and DGP 03 (9.53 t/ha) whereas DGP 06 showed the lowest (3.85 t/ha) fresh pod yield.

The present result is in similar pattern upto certain extent (for the highest fresh pod yield) but differed for the second highest and the lowest genotypes when compared with the results of other reports (Poudel *et al.*, 2017; Javaid *et al.*, 2002 and Chadha *et al.*, 2013). This study showed phenotypic diversity among the genotypes. Such variation would be important for the selection of high yielding and desired traits in variety development program.

## Conclusion

Based on the average yield, DGP 09 (10.08 mt/ha), DGP 01 (9.55 mt/ha) and DGP 03 (9.53 mt/ha) were found to be high yielding genotypes. Though the average yield was high in genotype DGP 01, the organoleptic performance was not so good whereas DGP 03 and DGP 09 were good with respect to organoleptic evaluation too. Based on the result of vegetative as well as yield performance of both the years, DGP 03 and DGP 09 seemed suitable for commercial cultivation in Rajikot or similar conditions in Jumla.

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