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STUDIES ON EFFECT OF DIFFERENT SEED RATE AND ROW SPACING ON GREEN PEA POD PRODUCTION IN COLD DESERT REGION OF H.P., INDIA

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Abstract

A field experiment on effect of different seed rate and row spacing on green pod production of pea was carried out at Regional Horticultural Research Sub Station, Dr. Y. S. Parmar University of Horticulture and Forestry, Tabo, Spiti, Himachal Pradesh, India during summer of year 2015 and 2016. There was significant interaction effect of seed rates and line spacing on the parameters like percent seed germination in field, pod length (cm), pod yield per plot (kg) and pod yield per ha (qt) during both the years. Maximum green pod yield per plot and per ha was observed in treatment combination of highest seed rate of 150 kg/ha and line spacing of 30 cm during both the year which was statistically at par with treatment combination of highest seed rate and line spacing of 22.5 cm. At closer row spacing of 22.5 cm there was lesser problem of lodging and stacking is also not required. Hence, highest seed rate of 150 kg/ha along with 22.5 cm can be preferred for growing late season varieties of pea in high hills of cold desert region of Himachal Pradesh.

Key words : Pea, seed rate, row spacing, cold desert region.

Introduction

The Lahaul and Spiti district of Himachal Pradesh is located in trans-Himalayan region of India spread over an area of 13,693 km^2. The sparsely inhabited district presents extreme climatic conditions because of the winter temperature plunging much below freezing, wide diurnal fluctuations in temperature, scanty rainfall, low air pressure and strong solar radiation. Grains like buckwheat (*Fagopyrum esculentum*) and barley (*Hordeum vulgare*) were the major crops cultivated in the two valleys, with black pea (*Pisum sativum* var. *arvense*) also cultivated as a local crop in Spiti valley. In the past three decades, the scenario changed with the introduction and replacement of traditional crops by pea (*Pisum sativum*) and potato (*Solanum tuberosum*) in Lahaul valley and pea and barley in Spiti valley (Mishra *et al*., 2003). Pea is the most important commercial crop of Lahaul & Spiti, tribal district of Himachal Pradesh. Cultivation of modern peas commenced in both valleys in early 1980s (Sharma *et al*., 2007). The success of pea cultivation depends on optimum plant density per unit area. Pea is sown through broadcast method in the cold desert region of Himachal Pradesh particularly in the Spiti area of district Lahaul & Spiti. In this method, seeds are unevenly distributed. They are placed either at very deep or left at the upper surface of soil which results in poor germination. The seeds placed at higher depth take either much time for emergence or fail to penetrate the soil and seeds left at the upper surface of soil are either get decay or eaten by birds which ultimately affects the final green pea pod production. Seed rate used in this method is also very high which is not economical due to higher cost of seeds. Furthermore, weeding and other intercultural practices are difficult in broadcast method of sowing. Sowing of seeds in line ensures less use of seeds per unit area and easy crop management practices like weeding, hoeing and irrigation. Land holding of farmers in the region is very small and there is need to enhance the pod production of pea. For maximum yield optimum plant population is must. Keeping these facts in view, the present study was planned to find the optimum seed rate

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and row spacing to get the maximum green pod production of pea.

Materials and Methods

The present study was carried out during summer of year 2015 and 2016 at Regional Horticultural Research Sub Station, Dr. Y. S. Parmar University of Horticulture and Forestry, Tabo, Spiti, Himachal Pradesh, India. The research sub station is situated at an elevation of 3285 m above mean sea level. The experiment consisted of twenty eight treatment combination comprising of four different seed rates (75 kg/ha, 100 kg/ha, 125 kg/ha and 150 kg/ha) and seven row spacings (60 cm, 52.5 cm, 45 cm, 37.5 cm, 30 cm, 22.5 cm and 15 cm) was evaluated using variety Lincon on a plot size of 2.0 m^2 in factorial randomized block design replicated thrice. Different treatment combinations along with seed to seed spacing on the basis of number of seeds sown per square meter and line spacing is given in the table 1. The average 100 seed weight was 18g. The observations were recorded on percent seed germination in field, plant height (cm), number of pods per plant, pod length, pod width, green pod yield per plot, green pod yield per ha, number of peas per pod and benefit cost ratio.

Results and Discussion

The data presented in table 2 shows that treatment combination of seed rate and line spacing has significant influence on percent seed germination in field, pod length (cm), pod yield per plot and pod yield per ha during both the years. Percent seed germination in field was recorded maximum in treatment combination of 45 cm line spacing with 100 kg/ha seed rate and treatment combination of 22.5 cm line spacing with 150 kg/ha seed rate during year 2015 and 2016 respectively which were at par with treatment combinations of LS5SR1, LS7SR2, LS1SR3, LS2SR3 and LS4SR3 during both the years. Treatment combinations had significant influence on plant height during year 2015 only. With decreased seed rate of 75 kg/ha along with line spacing of 45 cm recorded maximum

Table 1 : Seed to seed spacing on the basis of number of seeds sown per square meter and line spacing.

Treatment combinations	Seed Rate (kg/ha)	Line Spacing (cm)	No. of seeds/m^2	Seed to seed spacing (cm)
SR1LS1	150	60	84	2
SR1LS2	150	52.5	84	2.3
SR1LS3	150	45	84	2.6
SR1LS4	150	37.5	84	3.2
SR1LS5	150	30	84	4
SR1LS6	150	22.5	84	5.3
SR1LS7	150	15	84	8
SR2LS1	125	60	70	2.4
SR2LS2	125	52.5	70	2.7
SR2LS3	125	45	70	3.2
SR2LS4	125	37.5	70	3.8
SR2LS5	125	30	70	4.8
SR2LS6	125	22.5	70	6.3
SR2LS7	125	15	70	9.5
SR3LS1	100	60	56	3
SR3LS2	100	52.5	56	3.4
SR3LS3	100	45	56	4
SR3LS4	100	37.5	56	4.8
SR3LS5	100	30	56	6
SR3LS6	100	22.5	56	8
SR3LS7	100	15	56	12
SR4LS1	75	60	42	4
SR4LS2	75	52.5	42	4.5
SR4LS3	75	45	42	5.3
SR4LS4	75	37.5	42	6
SR4LS5	75	30	42	8
SR4LS6	75	22.5	42	10.6
SR4LS7	75	15	42	15.9

Table 2 : Interaction effects of seed rate and line spacing on yield and yield contributing factors of green pea pod production during the year 2015 & 2016.

Treat.	Percent seed germination in field		Plant height (cm)		Number of pods per plant		Pod length (mm)		Pod width (mm)		Green pod yield per plot		Green pod yield per ha (qt)		Number of peas per pod		B : C ratio	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
LS1SR1	48.37	61.79	44.63	47.53	7.13	6.60	89.43	89.30	13.57	13.58	0.98	1.01	49.16	50.83	7.00	6.60	1:0.08	1:0.13
LS2SR1	61.83	62.24	49.50	46.83	5.60	6.60	86.76	86.39	13.76	13.37	1.26	1.30	63.33	65.00	6.80	6.80	1:0.40	1:0.44
LS3SR1	54.45	55.25	34.83	48.6	6.66	7.00	85.85	85.61	13.35	13.53	1.77	1.80	88.66	90.33	6.53	6.46	1:0.96	1:0.99
LS4SR1	64.43	67.43	42.26	43.26	7.60	6.80	89.40	89.00	13.48	13.69	2.07	2.10	103.83	105.16	7.20	7.00	1:1.29	1:1.32
LS5SR1	73.98	73.37	43.76	51.43	7.20	8.43	93.99	93.34	13.92	13.89	2.34	2.37	117.00	118.67	7.26	7.26	1:1.58	1:1.62
LS6SR1	78.59	78.59	41.96	45.3	7.86	7.06	93.16	91.47	13.71	13.62	2.20	2.23	110.00	111.67	7.03	6.96	1:1.42	1:1.46
LS7SR1	61.47	64.48	32.56	38.9	7.06	7.06	90.79	89.70	13.75	13.69	1.53	1.66	76.66	83.33	7.00	6.93	1:0.68	1:0.83
LS1SR2	59.20	64.03	41.73	48.73	6.53	6.46	93.60	92.52	13.53	13.56	1.50	1.46	75.00	73.33	7.10	7.00	1:0.68	1:0.65
LS2SR2	68.95	69.43	44.53	47.00	6.46	6.76	92.35	91.84	13.53	13.56	1.72	1.74	86.00	87.33	6.93	6.70	1:0.93	1:0.96
LS3SR2	62.46	65.60	42.70	49.20	7.80	7.33	88.16	88.15	13.74	13.50	1.53	1.55	76.66	77.60	7.23	6.73	1:0.72	1:0.74
LS4SR2	55.68	62.20	31.10	44.83	7.73	7.46	87.11	85.17	14.15	13.87	0.98	1.38	49.16	69.00	6.86	6.93	1:0.10	1:0.55
LS5SR2	63.26	65.43	34.26	51.73	7.46	8.26	92.68	92.18	13.73	13.61	1.53	1.65	76.66	82.83	7.33	7.23	1:0.71	1:0.85
LS6SR2	63.25	66.40	43.10	47.76	8.33	7.26	86.09	86.00	13.07	13.35	1.43	1.43	71.50	71.50	7.16	6.96	1:0.60	1:0.60
LS7SR2	74.36	73.15	37.03	41.40	7.00	6.73	86.09	86.95	13.11	13.20	2.10	2.01	105.00	100.83	7.06	6.76	1:1.34	1:1.25
LS1SR3	79.27	77.78	44.13	50.80	7.13	6.40	89.94	89.75	13.94	13.75	1.61	1.61	80.83	80.83	7.43	7.26	1:0.85	1:0.85
LS2SR3	73.59	72.10	42.36	47.96	7.66	7.13	86.25	86.04	12.75	12.93	1.67	1.67	83.83	83.83	6.83	6.86	1:0.91	1:0.91
LS3SR3	84.74	72.00	41.86	48.86	6.60	6.93	84.85	84.58	13.49	13.43	1.72	1.72	86.16	86.16	6.56	6.66	1:0.96	1:0.97
LS4SR3	78.86	75.89	37.36	46.20	9.06	7.53	86.35	85.97	13.61	13.34	1.80	1.80	88.33	90.00	6.80	6.53	1:1.05	1:1.05
LS5SR3	73.26	71.77	42.26	49.53	7.06	8.06	84.14	83.51	12.70	12.64	1.05	1.21	52.50	60.83	6.80	6.90	1:0.19	1:0.38
LS6SR3	50.52	54.68	38.03	45.50	9.13	8.26	85.44	85.17	13.05	13.17	0.90	1.16	45.00	58.33	6.93	6.60	1:0.02	1:0.33
LS7SR3	46.58	50.15	46.76	44.96	7.66	7.33	82.62	82.34	13.07	13.10	0.98	1.16	49.00	58.16	6.83	6.53	1:0.11	1:0.32
LS1SR4	68.48	70.86	38.86	46.67	9.06	7.23	88.05	87.90	13.14	13.14	1.05	1.05	52.50	52.50	7.30	6.86	1:0.22	1:0.22
LS2SR4	76.36	72.79	40.96	47.76	6.13	7.36	84.19	84.95	12.98	13.10	1.31	1.26	65.83	63.16	6.87	7.03	1:0.52	1:0.47
LS3SR4	66.62	66.63	54.86	49.66	10.60	8.26	85.30	85.25	13.26	13.42	1.85	1.54	92.50	77.16	7.36	7.06	1:1.14	1:0.79
LS4SR4	61.69	66.45	47.23	51.56	10.53	8.80	83.66	83.89	13.13	13.40	1.48	1.58	74.16	79.16	6.80	6.53	1:0.71	1:0.83
LS5SR4	61.06	63.44	46.53	52.76	8.53	10.03	86.29	85.95	13.23	13.42	1.35	1.59	67.50	79.66	7.00	6.93	1:0.56	1:0.84
LS6SR4	62.81	67.97	46.76	47.76	11.20	9.00	88.20	88.38	13.15	13.21	1.14	1.35	57.00	67.67	7.40	7.03	1:0.31	1:0.56
LS7SR4	49.76	58.09	50.83	50.10	9.93	8.26	94.38	93.83	13.44	13.44	1.07	1.24	53.66	62.00	7.30	7.13	1:0.23	1:0.43
Mean	65.21	66.60	42.24	47.59	7.88	7.51	88.07	87.68	13.40	13.41	1.49	1.56	74.28	78.10	7.02	6.86		
$CD_{(0.05)}$	11.34	8.31	8.00	NS	NS	NS	2.77	2.99	0.35	NS	0.34	0.32	20.30	16.02	NS	0.30		

plant height. It may be due to less no of plants per unit area which facilitates the more nutrients availability to the plants and less competition for light and water. Significant effect of plant geometry on plant height in tomato was also reported by Bhattarai *et al*. (2015). Treatment combination of seed rate and row spacing had non-significant effect on number of seeds per pod. Similarly, non-significant effect of seed rate on number of seeds per pod was also reported by Sharma and Singh (2002). However, the highest seed rate of 150 kg/ha along with line spacing of 30 cm recorded maximum value for pod length, yield per block and yield per ha during both the years which were statistically at par with seed rate of 150 kg/ha along with line spacing of 22.5 cm during both the years for all the three characters. The increase in yield with the increase in seed rate may be due to the higher plant population per unit area. These findings are in agreement with those reported by Baswana and Saharan (1993).

Treatment combination LS5SR1 recorded highest benefit cost ratio followed by treatment combination LS6SR1 during year 2015 and 2016, respectively.

Conclusion

Based on present studies it can be concluded that with increase in seed rate there is increase in green pod yield at optimum spacing of 30 cm followed by 22.5cm. Both row spacing was found statistically at par for Green pod yield. Seed rate of 150 kg/ha and spacing of 22.5 cm can be preferred for growing late season pea variety like Lincon in cold desert region of Himachal Pradesh as at closer spacing problem of lodging is lesser and stacking is also not required.

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