

Studies on soil fertility, nodulation status in pea crop and cultural practices of pea growers in cold desert Spiti valley, Himachal Pradesh

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ABSTRACT

Pea (*Pisumsativum* L.) is the only cash vegetable crop of significance in Spiti Valley and is cultivated only in summers. However the production is beset with many problems such as excess use of seeds, imbalanced fertilizer usage and lack of availability of quality seeds. The present investigations were undertaken at Regional Horticultural Research Sub-Station, Tabo, Spiti, HP and Department of Soil Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP during the year 2010-11. The soil and plant samples were collected and analysed from 15 major pea growing locations in Spiti Valley. The perusal of the data revealed wide variation in soil nutrient composition. Soil pH at all locations was saline. The available phosphorus in the soil samples was high to very high while potassium was medium to high. The organic carbon content in most samples was moderate to high. The nodule number per plant showed wide variation in peas. The nodule protein and leghaemoglobin content in the plants also varied considerably. The survey to study traditional practices revealed that the seed is broadcast in large quantity rather than sowing in lines resulting in over-expenditure on seed. The present findings show that the manure and fertilizer application needs to be done on the basis of soil test reports in Spiti valley. Alternative methods of sowing such as line sowing and sowing after ploughing need to be adopted after some modifications.

Keywords: peas; nodules; leg-haemoglobin; fertility

INTRODUCTION

Spiti valley is one of the most inhospitable regions of the country. The valley is one of the few regions of the world

classified as 'cold desert' as per Koppen Climate Classification System. The desert like conditions prevail because the region lies beyond the greater Himalayan range contiguous with the Tibetan plateau called

the Trans-Himalayas. There is very low precipitation in this region due to the 'rain shadow effect' caused by the 6000 to 7000 metres high Himalayan peaks lying to the south of the valley. There are limited livelihood options due to a long and harsh winter and a very short summer for any agricultural activity. Pea (*Pisum sativum* L) is the only cash vegetable crop of significance in the region and is cultivated only in summers. However the production is beset with many problems such as excess use of seeds, imbalanced fertilizer usage and lack of availability of quality seed. Hence the present study was undertaken to study macro-nutrient status in fields, nodulation status in pea crop and the cultivation practices of the farmers at various locations in Spiti valley, Himachal Pradesh.

MATERIAL and METHODS

The present investigations were undertaken at Regional Horticultural Research Sub-Station, Tabo, Spiti, HP and Department of Soil Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP during the year 2010-11. The soil and plant samples were collected from 15 major pea growing locations in Spiti valley. Nodulated roots and shoots of five plants were collected from the cultivated fields from each of the 15 locations for recording observations. The soil samples were taken up to 15 cm depth from the cultivated pea fields. Composite soil samples from each location were used for

further analysis. Standard procedures were used to measure the soil parameters such as pH, EC, soil organic matter, nitrogen, phosphorous and potassium in per cent. Nodulation related studies were undertaken in the Department of Vegetable Science and Department of Basic Sciences of the university. Statistical analysis was done as per Gomez and Gomez (1984).

RESULTS and DISCUSSION

The data of the present study have been presented in Table 1 and Table 2. The perusal of the data reveals wide variation in soil nutrient composition. Soil pH at all locations was saline as also reported by Rahi et al (2011). The nitrogen content in soil samples was low to medium; the available phosphorous was high to very high while potassium was medium to high but exceptionally high at Rangreik and Shichling. Similar findings have been reported by Sharma and Kanwar (2012). The organic carbon content in most of the samples was moderate to high similar to the study of Sharma and Kanwar (2012).

The nodule number per plant showed wide variation in peas. It ranged from 10.00 at Butak to 43.75 at Mikkimas that is also reported by Shirkot et al (1997). The nodule protein and leghaemoglobin content in the plants also varied considerably. The leghaemoglobin content of nodules is highly correlated to nitegogenase activity (Vikman and Vessy

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Table 1. Soil fertility parameters at different locations in Spiti valley

Location	pH	EC (dS/m)	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)
Maane	8.28	0.23	2.31	169.30	67.20	572.30
Guling	8.33	0.18	1.08	250.80	504.00	320.30
Shichling	8.25	1.46	1.14	263.40	156.80	1377.60
Rangrik	8.29	0.30	4.98	470.40	257.60	1646.40
Poh	8.47	0.07	1.38	265.40	78.40	181.40
Kungri	8.14	0.05	1.92	395.10	156.80	573.40
Kibber	8.06	0.18	2.19	426.40	78.40	271.00
Butak	8.67	0.31	0.90	219.50	44.80	424.40
Tabo	8.39	0.29	2.10	407.60	168.00	386.40
Kewling	8.50	0.10	2.20	439.00	145.60	809.70
Muud	8.41	0.13	2.10	370.00	156.80	612.60
Dankhar	8.08	0.20	2.04	439.60	436.80	486.00
Sagnam	8.09	0.22	2.16	451.50	78.40	344.90
Mikkim	8.60	0.14	0.75	250.80	44.80	342.78
Chicham	8.15	0.08	1.50	275.90	134.40	459.20
Mean	8.31	0.26	1.92	339.65	167.25	587.23
SD	0.19	0.34	1.00	100.09	136.22	409.27
Confidence limit ($\pm$) 5%	0.10	0.17	0.51	50.65	68.93	207.11

Table 2. Nodulation status of pea farmers' fields in different villages of Spiti valley

Location	Root weight (g)	Fresh shoot weight (g)	Nodules/plant	Fresh nodule weight/plant (g)	Nodule protein (mg/g)	Leg-haemoglobin (mg/g)
Maane	1.30	13.10	15.50	0.33	5.23	1.09
Guling	1.74	32.04	21.25	0.21	5.49	0.95
Shichling	2.87	32.04	28.75	1.23	8.03	1.78
Rangrik	1.26	24.58	23.50	0.24	7.52	1.55
Poh	4.13	49.30	41.75	1.90	7.00	1.69
Kungri	1.24	27.32	10.00	0.39	6.53	1.44
Kibber	2.17	39.17	25.50	0.50	6.80	1.50
Butak	1.51	5.91	10.00	0.19	5.99	1.20
Tabo	2.10	7.51	26.50	0.34	4.53	1.00
Kewling	1.59	8.93	18.50	0.27	4.00	0.95
Muud	2.74	42.23	25.50	0.47	6.66	1.53
Dankhar	3.83	41.24	37.25	1.34	7.03	1.60
Sagnam	1.60	9.52	33.00	0.94	5.00	1.02
Mikkim	2.47	36.09	43.25	1.13	6.50	1.23
Chicham	3.41	39.48	31.50	0.79	7.03	1.62
Mean	2.26	27.23	26.12	0.68	6.22	1.34
SD	0.95	14.70	10.24	0.52	1.15	0.29
Confidence limit ($\pm$) 5%	0.48	7.44	5.18	0.26	0.58	0.15

1993) and has close association with nitrogen fixation efficiency (Suganuma and Yamamoto 1987). The survey to study traditional practices revealed that the seed was broadcast in large quantity rather than sowing in lines resulting in over-expenditure on seed. The seed was first broadcast in the fields followed by ploughing. Large quantity of seed was either ploughed under or came to the surface. The manure being used was mostly sheep manure and rarely FYM. The synthetic fertilizers were being used by a fairly large number of farmers. However knowledge about manure and fertilizer requirement and type of fertilizers such as N,P, K was negligible. Farmers added fertilizers even without requirement and also applied whichever fertilizer was locally available.

The present investigations revealed wide variation in essential soil parameters including nutrient levels in the valley. The alkaline pH of soils in Spiti appears to be due to lack of sufficient rains and irregular irrigation. Practices like broadcasting of seeds followed by ploughing especially in case of bold seeded crops like pea caused high wastage of seed and consequent economic losses to the farmers.

The present findings show that the manure and fertilizer application needs to be done on the basis of soil test reports in the valley. Alternative methods of sowing

such as line sowing and sowing after ploughing needs to be adopted with some modifications. Irrigation practices need to be improved to ameliorate saline soil conditions being caused due to alkaline pH.

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