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Improving Crop Production through On-Farm Testing in Frontier District Kupwara, India

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A B S T R A C T

During the past few years farmers participatory research trials have rapidly gained popularity with due consideration being given to the knowledge, problems and priorities of the farming families. Peas, potato and turnip are important vegetables cultivated by growers of district Kupwara. A series of on - farm trials were laid on pea, potato, turnip and walnut to assess the impact of technologies and test their performance in district Kupwara. The application of rhizobium @3kg/ha. recorded yield of 10.50q/ha followed by rhizobium @2.0kg/ha which recorded an average yield to the tune of 10.15 q/ha. The increase in yield may be due to direct contribution of bio-fertilizers in improving the fertility of soil because of bacterial activity. The highest yield was recorded in PP- 2500 (Shalimar Potato -1) which attained the yield of 210q/ha followed by Gulmarg Special (175q/ha.). The lowest yield was found in the local variety cultivated by the farmers. The maximum yield was recorded under both the varieties of turnip tested i.e., 290 q/ha. in comparison to farmers own variety (180q/ha.). Cool and moist climate is most favourable for growing turnip. The roots develop best flavor, texture and size at a temperature of 10-15^{o}C. The yield is governed by accumulation of carbohydrates and other metabolites which depend ultimately on the synthesis and supply of photosynthates by leaves and their subsequent translocation vertically downwards to the root. An increase in germination of walnut was found by subjecting nuts to two months of stratification periods. Root and shoot length was also observed to increase with stratification period.

Introduction

The farmers of district Kupwara are growing vegetables with vegetable farms spread across many parts of the district. They work diligently in their farms and grow vegetables like kale, carrot, peas, potatoes, turnip, knol khol, spinach, cabbage, tomatoes, onions, and several others. They have a very good market as they send their fresh produce to various towns besides supplying the produce to the army in frontier areas. Family farming particularly in vegetable growing is one of the most predominant forms of agriculture prevailing in the valley of Kashmir. The district Kupwara is no exception to this type of farming. With majority of vegetable growing in the area is of family farming pattern. Being

labor intensive, most members on a vegetable farmer's family involve themselves in the cultivation process with good economic dividends. It plays a crucial role in their overall socio-economic development. They operate in different economic, agro-ecological and social contexts ensuring food security while meeting societal expectations for food safety, quality, value, origin and diversity of food and thus contribute to smart, sustainable and inclusive growth. It is believed that family farming can have a significant role to play in eradicating poverty ensuring sustainable management of natural resources and ecosystem services and preserve local heritage. This sector comprises a wide spectrum of farm sizes and types ranging from very large land holding in high income economics that are easily cultivated by one or more family members with the use of labour saving machinery and hired labour to the small holding in low income economics often oriented towards subsistence with low market surplus. Peas, potato and turnip are important vegetables cultivated by vegetable growers of district Kupwara.

Pea (*Pisum sativum*) is an important vegetable growing throughout the world. It is a cool season crop extensively grown in temperate zone and thus also restricted to cooler attitudes in tropics and winter season in sub tropics. Pea requires cold and dry climate while longer cold spell increases its yield. Potato (*Solanum tuberosum*) is believed to have been introduced in India from Europe in early 17^{th} century. The potato is grown in almost all the states in India and under diversified agroclimatic conditions. In north western hills, potato is cultivated since later part of 19^{th} century. Over the years, its area, production and productivity has increased significantly and today potato occupies important place in hill agriculture. In Jammu & Kashmir, area under potato is 6540 ha. with a total production of 89.58 thousand tones and yield 137.0 q/ha(Sharma,*et.al*.,2012). Turnip (B*rassica rapa)* is grown in temperate, subtropical and tropical regions of India. Cool and moist climate is most favourable for growing for turnip. However, it can be grown where summers are mild. The roots develop best flavor, texture and size at a temperature of 10-15^{o}C. The short day length and cool weather favour proper development of roots. Turnip varieties are divided in two groups – Asiatic or tropical types and European or temperate. These can further be classified on the basis of root shape as well as on skin and flesh colour. Walnut (*Juglans regia* L.) is the most important temperate nut fruit of the district. However, in temperate fruit trees the seeds fail to germinate when sown immediately even if conditions are favourable. Moreover, the farmers sow nuts in winter and sometimes the land is not feasible for sowing owing to early snow fall /rains which result in inundation of the land making it unfit for sowing nuts. Keeping in view the involvement of farm families plus the importance of vegetable growing and walnut plantation among fruit crops in the district, a series of On- farm trials were laid on pea, potato, turnip and walnut to assess the impact of technologies developed by SKUAST – Kashmir at farmers field.

Materials and Methods

The present study was conducted in three villages of Langate zone. The villages were purposively selected because of large number of farmers' participation in the KVK activities. The farmers were selected on the basis of area under vegetable, knowledge about the crop and the past experience of raising crops coupled with package of practices followed in vegetable cultivation. In each village two locations were selected-one for laying out On Farm Testing in vegetables and another location for walnut testing. Potato was sown during Khareif season while as pea

and turnip was sown during Rabi-2009 at farmer's field of block Langate. Prior to planting, the land was prepared thoroughly by ploughing 3-4 times followed by planking for clod breaking and leveling. Soil was prepared thoroughly for enhancing germination and seedling growth.

Introduction of high yielding recommended / SKUAST -K released varieties of vegetables like potatoes (PP-2500 and Gulmarg Special): turnip (Purple Top White Globe, Nigeen-1) were used to test their performance under the microclimatic conditions of the district. The existing varieties, land races were used as check in both the vegetables. The pea seeds were inoculated with rhizobium bacteria. The seeds were first mixed with 10% sugar solution. The vermicompost inoculated with rhizobium was spread over the seeds, mixed thoroughly and then sown in the field @ 1.5kg, 2 kg and 3 kg per hectare. The fertilizers were applied as per package of practices. The trial was repeated at three locations in the zone. All the three vegetables were planted according to recommended commercial spacing guidelines. Plot sizes were designed to be large enough so that there is enough population in each plot. Crops were irrigated and weeded as and when needed throughout the season. These trials were conducted to assess the performance of varieties in potato and turnip to update variety selection suitable for the local market of Kupwara. These On - farm trials were intended to help gardeners and farmers choose varieties that perform well in the local environment of the district. On farm testing on walnut was conducted at three locations each in one village of Langate. Stratification of seeds was done by keeping walnut in perforated tin trays with alternate layers of moist sand. The sand was kept moist by sprinkling water as and when required. The seeds were stratified for 20, 40 and 60 days to find out the best stratification period for breaking dormancy and facilitating germination. The trials were laid with the active involvement of scientists. The trainings were imparted to the farmers on On- farm testing, cultivation practices of the crops in question and technologies available with the Kendra. Yields for each replication were summed, then averaged by cultivar and reported in terms of yield per plot.

Results and Discussion

The application of rhizobium resulted in significant improvement in the yield of pea (Table 1). The application of rhizobium @3kg/ha. recorded yield of 10.50q/ha followed by rhizobium @2.0kg/ha which recorded an average yield to the tune of 10.15 q/ha. The increase in yield may be due to direct contribution of biofertilizers in improving the fertility of soil because of bacterial activity. Numerous species of soil bacteria which flourish in the rhizosphere of plants, but which may grow in, on, or around plant tissues, stimulate plant growth by a plethora of mechanisms. These bacteria are collectively known as PGPR (plant growth promoting rhizobacteria). Seeds dressed with rhizobium and plant grown in soil inoculated with rhizobium showed high seed germination and stimulatory growth over the control (Pawar et.al.,2014).These results summarized that rhizobium can be effectively used as a bioinoculant or biofertilizer to enhance the yield of crops.

Among the various potato varieties tested the highest yield was recorded in PP- 2500 (Shalimar Potato -1) which attained the yield of 210q/ha followed by Gulmarg Special (175q/ha.). The lowest yield was found in the local variety cultivated by the farmers (Table 2). While working on the effect of different nitrogen levels and nitrogen use efficiency of various potato cultivars, Faheema *et al.*, (2017) also recorded highest tuber yield in Shalimar Potato-1 variety.

Table.1 Effect of rhizobium culture on yield of pea

Title of OFT	No. of trials	Technology Assessed	Production (q/ ha.)	Results of assessment	Feedback from the farmer
Effect of *rhizobium* culture on yield of pea.	03	T0=Farmer's practice Nil T1=1.5 kg/ha T2=2.0 kg/ha T3=3.0 kg/ha	9.25 9.90 10.15 10.50	3.0 kg/ha. resulted in an increase in yield.	Unawareness and non-availability of the product

Table.2 Performance of potato var.PP-2500 (Shalimar Potato -1)

Title of OFT	No. of trials	Technology Assessed	Data on the parameter (q/ha)	Results of assessment	Feedback from the farmer
Performance of potato var.PP-2500	03	T0=Farmer's practice (local variety) T1=PP-2500 T2=Gulmarg Special	160.0 210 175	PP2500 is the best cv for the location.	Non availability of seed.

Table.3 Performance of turnip cultivars

Title of OFT	No. of trials	Technology Assessed	Data on the parameter (q/ha)	Results of assessment	Feedback from the farmer
Performance of turnip cultivars.	03	T0=Farmer's practice(local variety) T1=Purple Top White Globe T2=Nigeen-1	180 290 290	Both the varieties recorded an increase in yield. Farmer preferred Nigeen-1 as the cooking quality of nigeen-1 was better.	Farmer preferred Nigeen 1.

Table.4 Effect of stratification on germination of walnut

Title of OFT	No. of trials	Technology Assessed	Data on the parameter			Results of assessment	Feedback from the farmer
			Germination (%)	Shoot length (cm.)	Root length (cm.)		
Effect of stratification on germination of walnut.	03	T0=Farmer's practice (direct sowing) T1=20days T2=40days T3=60days	52.80 TI: 60.72 T2: 67.43 T3: 78.50	16.5 19.8 23.8 27.4	18.3 22.6 24.4 30.7	Stratification for 60 days was effective in increasing germination percentage.	Farmer was satisfied with the technology.

The yield per plot is an important trait deserving high consideration in any varietal selection programme. However, the farmers showed tendency towards Gulmarg Special due to taste attributes and preference for the said variety.

The data presented in Table 3 indicated significant difference in yield among various varieties of turnip at all the three locations. The data revealed that maximum yield was recorded under both the varieties tested i.e., 290 q/ha. in comparison to farmers own variety (180q/ha.). While evaluating 11 genotypes of turnip, Dua *et al.,* (1981) recorded highest yield per plant in Purple Top White Globe variety which is in accordance to our findings. The yield is governed by accumulation of carbohydrates and other metabolites which depend ultimately on the synthesis and supply of photosynthates by leaves and their subsequent translocation vertically downwards to the root.

Table 4 reveals that all the treatments provided better germination of walnut as compared to control. Maximum germination percentage was recorded with 60 days of stratification. Percentage germination increased with increased periods of stratification and 60 days duration resulted in maximum percentage germination (78.50%). The maximum shoot length of walnut seedlings (27.4cm.) was recorded under 60 days of stratification followed by 30 days of stratification which recorded 23.8cm of shoot growth. The lowest root growth (18.3cm.) was recorded under control and the root length increased with increased periods of stratification. Maximum root length (30.7 cm.) was recorded under 60 days of stratification. Parvin *et al.,* (2015) also recorded an increase in germination of walnut with combined application of gibberellic acid and two months stratification periods. Root length and shoot length was also observed to increase with combined plant growth regulator and stratification period. The results showed that walnut seeds exhibit an endogenous dormancy that might be removed by priming with moist chilling for a certain period of time. In addition the improved effect of seed germination by stratification may reflect on enhancing the growth parameters like root and shoot growth. The results showed that walnut seeds exhibit an endogenous dormancy that might be removed by priming with moist chilling for a certain period of time. In addition the improved effect of seed germination by stratification may reflect on enhancing the growth parameters like root and shoot growth. These results are in agreement with Pipinis, *et al.,* (2012) in Prunus mahaleb.

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