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Multipronged approaches of KVK for enhancing agricultural production in micro-climatic conditions of the district

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Abstract
Krishi Vigyan Kendra Kupwara is engaged in providing timely supply of proven technologies specific to various micro-climatic locations in operational areas thus alleviating the technology fatigue existing in the district. The various extension methods like FLD, OFT, method demonstration, campaign, group discussion etc., are being employed to extend new knowledge and skill to the farmers in operational areas. The front line demonstrations on cereals (paddy, wheat, maize); oilseed crops (Brown Sarson), pulses (pea) and oats were conducted on farmers field. Under FLDs, latest components were demonstrated i.e. latest released varieties, fertilizers, date of sowing, ICM, IDM for respective crop. The yield of paddy was recorded to the tune of 64 q ha-1 demonstrating an increase of 28% in the yield as compared to local variety. The low tunnel technology demonstrated to farmers in the spring was encouraging for higher belts as there is always the possibility of dip in mercury during the preparation of nursery. The number of FLD's under maize was highest benefitting 126 farmers covering an area of 10.8 hectares. The results depicted an increase of 111% yield and proved instrumental in improving the livelihood of the farming community. Introduction of Shalimar Wheat -1 sown during second/third week of October combined with pre-sowing irrigation had a tangible impact on yield (30q/Ha).The On- farm testing on onion, pea and cucurbits was laid in the farmers field and executed under the supervision of the scientist. The application of different doses of sulphur resulted in significant improvement in the yield and shelf life of onion. The application of sulphur @40kg /ha. recorded yield of 272q/ha and increased the shelf life more than 67 days as against control. Blanching with KMS @2g/l of solution for three minutes followed by sun drying reduced the extent of browning (5%) of dehydrated cucurbit. OFT on pea revealed that second week of October is best in terms of yield which decreased drastically by end of October sowing. Seeds may be sown when the soil has optimum moisture content for crop germination and establishment. The various technologies that were demonstrated and tested in the farmers fields of operational areas at district level showed promise and the farmers were highly satisfied with the results.

Keywords: Technology innovation, field crops, vegetables, FLD, OFT

Introduction
The varied agro-ecological conditions of Jammu and Kashmir range from subtropical to temperate and cold arid which permit successful cultivation of almost all deciduous fruits and a wide variety of vegetables. The economy of Jammu and Kashmir is essentially agrarian. Agriculture is the main source of livelihood of district Kupwara (Anonymous, 2011) [1]. Rice maize, wheat and oilseeds are the various crops which are grown under cereal based production system. Pulses are also part of the farming system and other resources with the farm family at the centre managing them independently or in complex diverse mixed form giving rise to multiple sustainable approach. Seventy four per cent of agricultural holdings are below 1 hectare. Agri/Horticulture production is up and supports four-fifth of population. Tourism in peace time involve and engage only one-tenth of population. Thirty one per cent of population depends on horticulture for their livelihood (Wanchoo, 1998) [4]. In Kashmir division, the area under vegetables is increasing tremendously. However, the various factors responsible for present low productivity of vegetables in Kashmir are non availability of adequate quantity of planting material/seed of improved varieties/hybrids, poor and traditional practices for nursery raising and poor agro techniques followed for vegetable production,

imbalanced nutritional management, incidence of pests and diseases, lack of post harvest care and poor marketing facilities available with the vegetable growers. Krishi Vigyan Kendra is on front line to promptly demonstrate the latest agricultural technologies to the farmers as well as extension workers of the line department with a view to reduce the time lag between the technology generation and its adoption. Moreover, it also test and verify the technologies in the socio-economic condition of the farmers with a view to study the production constraints and to modify the technologies to make them appropriate. KVK is engaged in disseminating proven technologies that helps to produce good quality crops besides improving production in order to improve livelihood of farming community.

Materials and Methods

KVK devised a comprehensive methodology as per the priorities keeping in view the prevailing farming system in the operational area. The problems of the particular farming situation were studied and available technologies from the parent institution SKUAST Kashmir were demonstrated so that farmers could get the maximum returns. The scientists developed an understanding of farmers, their farming system, resources to establish rapport with them. It is essential to gather information on cropping system, present level of use of inputs and productivity of major crops of the area. Good field demonstration lead to higher adoption of demonstrated practices by the farmers as they develop the confidence amongst them in practices demonstrated. Two blocks one (Sogam) at higher elevation and another (Langate) at lower elevation were purposively selected for mandated activities like Front Line Demonstration, On-farm testing, Field Diagnostic Visits, Method Demonstration, Field Day, training etc. The Front line demonstrations on cereals (paddy, wheat, maize); oilseed crops (Brown Sarson), pulses (pea) and oats were conducted on farmers field. Under FLD^s, latest components were demonstrated i.e. latest released varieties, fertilizers, date of sowing, ICM, IDM for respective crop. Agriculture implements to reduce drudgery of women and technologies to reduce cost of production etc. were also demonstrated. Field days were conducted to assess the impact of new technologies at maturity stage of the crop to the stake holders. The impact of transfer of technology was assessed in terms of per cent increase in yield (Samui *et al.*, 2000) [5]. KVK formulated OFT on vegetables in farmers field under the farmers condition and management by using farmers own practice as control. It helps to develop innovations consistent with farmers circumstances, compatible with the actual farming system and corresponding to farmers goals and preferences. The On- farm testing on onion, pea and cucurbits was laid in the farmers field and executed under the supervision of the scientist.

Results and Discussion

Socio-economic development of Kashmir valley depends largely on agriculture and SKUAST Kashmir is engaged in developing new technologies to enhance productivity and quality of food grains, fodder crops and vegetables besides other technological products. Krishi Vigyan Kendra Kupwara is spearheading strategies related to technology demonstration, assessment and refinement coupled with their dissemination in the field of agriculture and allied sectors. Under FLD programme major cereals, oilseeds, pulses, cash crops, horticulture crops are covered and is an effective learning situation as farmers see the crops themselves, interact with the scientists and extension workers on the fields. It is therefore essential that whatever demonstrations are conducted they should be well planned and executed giving no chance to fail. One bad demonstration can vanish the impact of many good demonstrations. Scientist therefore, has to be very careful in planning and conducting the field demonstration. Without specific purpose, demonstration should not be organized. It should be organized only when situation demands. Major focus is to resolve issues prevailing in the micro climatic conditions of the operational areas under the aegis of KVK.

KVK gives emphasis on improving productivity of cereals, oilseeds and pulses. KVK introduced Jhelum, Composite (C-8) and Shalimar Wheat-1 in paddy, maize and wheat respectively. Rice being the principal and traditional crop of the valley is free from devastating insect-pests that plague the tropical and sub-tropical rice culture. The crop is responsive to human efforts and other inputs, thereby paving the way for higher productivity in the only temperate zone of India. The technologies demonstrated for improving the yield and quality in paddy was introduction of variety coupled with nursery management followed by use of three seedlings per hill with line sowing at the time of transplanting and INM. As shown in Table-1, the yield of paddy was recorded to the tune of 64 q ha^{-1} demonstrating an increase of 28% in the yield as compared to local variety the low tunnel technology demonstrated to farmers in the spring was encouraging for higher belts as there is always the possibility of dip in mercury during the preparation of nursery. The nursery is prepared in strips of 1m wide and this area is covered with polythene sheets which is placed on fixed willow sticks to form a low tunnel. The polythene sheet on both sides are covered with dry soil or pebbles. The technology proved beneficial to farmers as it was affordable and cheap besides being successful. In maize the composite(C-8) released by SKUAST Kashmir was given at higher altitude areas of the district. The number of FLD's under maize was highest benefitting 126 farmers covering an area of 10.8 hectares. Maximum yield was recorded under demonstration to the tune of 36q/ha as against 17q/hectare under control. This exhibited an overwhelming increase in 111% yield and proved instrumental in circumventing food grain paucity of the tribal beneficiaries. The farmers were enthusiastic because of big cob size having good yield potential. Moreover, they prefer white colour maize as their staple food. Wheat is grown as Rabi crop and is predominantly a rain fed crop especially in foothills and hilly terrains of the area. Introduction of Shalimar Wheat -1 sown during second/third week of October combined with pre-sowing irrigation had a tangible impact on yield(30q/Ha).The farmers of the operational area were not well versed with the production technologies of wheat. Moreover, the stray grazing animals posed a threat to rabi crop as the surrounding fields were fallow during the season. KS-101mustard recorded yield of 8.1q/ha as compared to local check (6.45q/ha.). Seed yield was highest with sulphur @30kg/ha for different *Brassica* species (Malhi *et al*. 2007) [3].

Use of nutrient management, application of sulphur and timely sowing to increase the yield, seed production and harvesting at proper time were some of the interventions along with demonstrations of the new varieties that have helped to adopt mustard as a major income source during rabi. The variety of mustard has shown significant performance in increasing yield over traditional variety. The farmers are adopting the technological options like use of INM, IPM,

application of sulphur and water management. Major focus is given only on variety and timely sowing as there is yield loss up to 25 due to delayed sowing and use of local variety. Oats is also an important forage crop of the district and KVK has laid demonstrations from past few years on large scale. Total 09 demonstrations were conducted in the operational area. The oats growers have mainly adopted timely and proper sowing and nutrients management practices which showed a good promise in terms of production. The average increase in yield was 19.0 per cent. The pea variety Rachna on an average attained yield to the tune of 8q/ha and recorded 20% increase in yield as compared to control.

The climate and topography combined with other favourable conditions of Jammu & Kashmir provide a vast potential of producing vegetables, both normal and off-season, and could make the produce regularly available to the neighboring plains. Kashmir province has made a commendable progress in vegetables production, from about 2 lakh Mt (1980-81) to over 5 lakh Mt. During this period, the area and productivity of vegetables have also shown significant increase of about 137 per cent and 11 per cent, respectively. SKUAST-K released varieties were introduced which performed better in terms of quantity as well as quality and also resulted in diversifying the varietal profile. Three On-farm testing trials were laid in the operational areas with the active involvement of farmers, line departments and KVK scientists. The crops selected were onion, pea and cucurbits based on the feedback from the progressive farmers of the area. An On-farm trail aims at testing a new technology or an idea in farmers field under the farmers condition and management by using farmers own practice as control. It helps to develop innovations consistent with farmers circumstances, compatible with the actual farming system and corresponding to farmers goals and preferences. The stakeholders besides farmers are SMS who help him to overcome their problem and improve their economic situation. The On- farm testing is practiced and executed under the supervision of the scientist. The extension system and government itself who is interested in seeing an efficient and participatory technology development model evolving, since most top down approaches have failed miserably.

The application of different doses of sulphur resulted in significant improvement in the yield and shelf life of onion (Table-2). The application of sulphur @40kg /ha. recorded yield of 272q/ha and increased the shelf life more than 67 days as against control that recorded 30 days of shelf life. The next best treatment was 30kg/ha sulphur followed by 20kg/ha which recorded an average yield to the tune of 252 q/ha and 230q/ha with an increase in shelf of 30 and 46 days with respect to reference date of control respectively. S is an important constituent of amino acids like systhein and methionine and as such of proteins and also an important constituent of acetyl co-enzyme A. It is involved in synthesis of glucosides in brassicaceous plants.

The Table -3 reveals that treatment with potassium metabisulphite proved beneficial in improving the quality of bottle gourd. Blanching with KMS @2g/l of solution for three minutes followed by sun drying reduced the extent of browning (5%) of dehydrated cucurbit in comparison to farmers practice i.e. sun drying in which the extent of browning was 45%.Due to perishable nature and lack of adequate storage facility in and around markets, no part of surplus vegetable can be hoarded in anticipation of price hike. In this back drop small to medium scale farmers were selected to develop value added products that do their own processing and sell their products directly to the customers through farmers market, individuals and high end grocery stores.

Sowing date is one of the important parameters that influence the yield of pea. As is evident from Table-4 sowing of pea on 15th of October recorded 9.80q/ha and the yield was greatly reduced by delaying sowing up to 25th of November. These results corroborate the findings of Hamid *et al*., 2015 [2] where under, different sowing dates has a direct impact on enhancing yields and first ten days of September were the most suitable time to get maximum yield. Seeds may be sown when the soil has optimum moisture content for crop germination and establishment. Soil moisture conditions can be achieved after rainfall, irrigation and drainage or from conserved water.

The various technologies that were demonstrated and tested in the farmers fields of operational areas at district level showed promise and the farmers were highly satisfied with the results. The technologies percolated down in the farming community as the farmers are approaching KVK for SKUAST- K released seeds, recommendations, trainings and other r inputs.

Table 1: Performance of FLD

S. No.	Crop	Technology Demonstrated	Variety	No. of Farmers	Area (ha.)	Demo. Yield Qtl/ha			Yield of local Check Qtl./ha	Increase in yield (%)
						H	L	A		
1.	Brown Sarson	Variety, Presowing irrigation, Sulphur application, timely sowing, proper fertilizers	KS-101	80	15.0	10.5	7.0	8.75	7.0	25
2.	Pea	Rhizobium culture, ICM	Rachna	40	5.0	11.5	7.0	8.3	6.0	30
3.	Rajmash	Variety, INM, ICM	Shalimar R1, Canadian Red	11	5.00	8.5	6.8	7.8	5.8	34
4.	Moong	Seed rate, Mixed cropping, Pre-sowing irrigation, Rhizobium culture	Shalimar moong1	10	3.00	7.8	6.5	7.5	5.2	44
5.	Paddy	Variety, Timely & proper fertilizer, Disease Mgt., water mgt., nursery raising	Shalimar Rice 1	46	10.0	80	60	68	55	25
6.	Maize	Varirty, Line sowing, mixed cropping	Composite	56	20.0	45	35	40	20	100

Table 2: Effect of sulphur on the shelf life of onion

Title of OFT	No. of trials	Technology Assessed	Parameters of assessment	Production per unit (qha^{-1})	Results of assessment	Feedback from the farmer
Effect of sulphur on shelf life of onion	10	T1;Farmers' practice (No sulphur), T2:S@20 Kgha^{-1} T3:S@30 Kgha^{-1}	Shelf life (Days after harvest)	180, Sprouted after 30 days of harvest 230, Sprouted after 60 days of harvest 252, Sprouted after 76	Application of sulphur increased the shelf life	Sulphur application accompanied with mgt. practice improved the shelf life.

		T4:S@40 Kgha^{-1}		days of harvest 272, Did not sprout up to 76 days of harvest		

Table 3: Sun drying of cucurbits

Title of OFT	No. of trials	Technology Assessed	Parameters of assessment	Parameters of assessment (Extent of Browning)	Results of assessment	Feedback from the farmer
Sun drying of cucurbits	03	T1: Sun drying T2:3 minutes dipping in boiling water+T1 T2: Dipping with 2 g/ l solution of potassium metabisulphite+T2	Extent of browning	45% 20% 5%	Blanching, chemical treatment reduced browning.	Blanching for 3 minutes followed by sun drying gave the best results

Table 4: Effect of different sowing dates on the yield of pea

Title of OFT	No. of trials	Technology Assessed(Sowing Date)	Parameters of assessment	Production per unit (qha^{-1})	Results of assessment	Feedback from the farmer
Effect of different sowing dates on the yield of pea	04	T1: 15th October T2: 25th November T3: Ist week of February	Shelf life (Days after harvest)	6.00 9.80 8.75	October sowing followed by February gave the best yields	Lack of moisture effects the October sowing

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