Success stories under RKVY project Remapping of fruit growing areas using geo-spatial technologies to support crop planning under changing climate in subtropics of Himachal Pradesh

Name of Organization: YSP University of Horticulture and Forestry, Nauni, Solan

Location: Department of Fruit Science, College of Horticulture and Forestry, Neri Hamirpur, Himachal Pradesh

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Source of Funding: RKVY

Success stories of project:

A. Crop models as showcase of Technology suitable under changing climate for frost prone /non-frost/rainfed areas and under rising temperature

High density planting of different fruit crops has been established and maintained at experimental farm, Neri. These crop models devised in accordance with the suitability of soil, topography, aspect and agroclimatic situations such as frost prone and non-frost areas on undulated topography of wasteland. The modern technology regarding soil, water and nutrient management has been demonstrated on undulated sloppy land through drip and fertigation system along with black polyethene mulching for orchard floor management. Drip and fertigation system have been laid out in the orchard of different fruit crops on undulated topography to enhance the productivity and qualitative attributes of different fruit crops besides increasing the water and nutrient efficiency. This technique has proved cost effective by way of automation of water and fertilizer supply to the root zone. Farmers of the hill area are keenly interested for its adoption at their own farms. The high density planting through canopy management and spacing in different crops has been demonstrated and being maintained as given below:

Crop Model I. for frost prone / non- frost areas and wastelands

Demonstration block on raised bed precision technology for high density planting in pomegranate has been developed at the Neri farm of the college (Fig.2).

The crop production models for sloppy wastelands and flat valley areas have been demonstrated at the college farm side by side, which provide unique opportunity for the farmers and orchardist of the subtropics of the state to adopt the site-specific technology. The raised bed technology is best suited to the flat, water logged, rocky wasteland with manifold benefits over existing practices, by minimising the incidence of root diseases and enhancing the soil health which increases the quality of the produce.

Figure 1Raised bed technology

Fruit Crop	Name of Cultivar/Variety/Strain	Spacing(s)
Pomegranate	Kandhari Kabuli, Bhagwa, Phule Super Bhagwa	2.5 x 2.5 m, 3.0 x 2.5 m 4.0 x 3.0 m

Crop Model II. for moderate frost / non- frost areas and wasteland

High density and ultra-high density orchards of guava for frost free and moderate frost areas on waste steep sloppy land. Rainy season guava crop has been considered unprofitable due to poor quality marketable produce. The crop regulation technology for quality winter guava crop production through canopy management, wherein, minimal usage of pesticides, fungicides has minimised the cost of production. Winter guava crop production technology has proved potential to make guava farming a profitable enterprise in the subtropics of the state which has been exploited in the adjoining states as well.

Fig . Ultra High Density Planting of Guava

Fruit Crop	Name of Cultivar/Variety/Strain	Spacing(s)
Guava	Shweta, Lalit, Pant Prabhat, L-49, Allahabad Safeda, Arka Kiran, G-6(Red guava)	Ultra High Density Planting: 2.0 x 1.0 m High Density Planting: 2.0 x 2.0 m and 3.0 x 2.0 m

Crop Model III For frost prone / non- frost irrigated areas with deep fertile soils

High density planting of citrus particularly mandarins, sweet orange, acid lime sweet lime and grapefruits has been demonstrated on the farm field facing towards North-western aspect which provide uniform moisture regime and enhances water use efficiency for better qualitative and quantitative attributes of of the fruit. The selection of the site for citrus fruit is crucial for successful cultivation and the North-western aspect is helpful to minimise the incidence of insect pests and diseases, which is otherwise a major problem for establishment of citrus orchard and its profitability.

Fig: High Density planting of Kinnow

Fruit Crop	Name of Cultivar/Variety/Strain	Spacing(s)
Citrus	i. Mandarin: Kinnow, Daisy mandarin, W-Murket, ii. Sweet orange: Malta, Blood Red, Musambi, Jaffa, Valencia iii. Grape fruit-Red flush, Star Ruby iv. Acid Lime: Pant Lemon, Punjab local, Kagzilime, Baramasi v. Sweet lime: Punjab Sweet lime	2.5 x 2.5 m

Crop Model IV. For frost prone / non-frost areas:

Low chill peach cultivation in subtropics of Himachal Pradesh has not been exploited so far on large commercial scale, whereas, across the geographical boundaries of the state i.e. parts of Punjab, Haryana, Uttar Pradesh, Uttrakhand and Jammu peach cultivation is quite popular among farming community because the produce comes in the market at a time during April-May (peak summer) when the availability of fresh domestic fruit is scarce. Farmers in these states are getting remunerative prices in the

High density planting of peach (low chill)

market to the tune of Rs 40-50/- . In this direction a high density model of low chill peaches has been demonstrated on sloppy wasteland which is suitable for small and marginal land holdings. Fruit mature in the first fortnight of May which have no competition in the market neither from the produce of adjoining states nor from mid-hill zone. Hence the farmers of the area particularly facing high frost and devoid of frost areas can fetch remunerative prices in the market for their produce.

Fruit Crop	Name of Cultivar/Variety/Strain	Spacing(s)
Peach (Low Chill)	Glow Haven, Royal Paradelux, Florda Prince, Partap, Shan-e-Panjab, Early grande	2.0 x 2.0 m Pillar System

Crop Model V. High Density planting on south-east facing sloppy wasteland shallow strata under moderate areas:

Mango is considered the most important fruit crop with respect to area and production in the subtropics of the state. However, the conventional mango cultivation has become non-profitable enterprise and the farmers are either uprooting the existing plantations or have neglected the orcharding of mango because of planting traditional cultivars i.e. Dashari and Langra. To make mango cultivation profitable venture in the subtropics of the state, high density planting of late season cultivars has been demonstrated which is suitable for small and marginal land holdings which forms a major proportion of the farmers in this part of the state. The late varieties have seasonal advantage over traditional early and mid-season varieties of mango which have synchronous maturity with the neighbouring states. The planting of mango orchards on South-eastern facing aspect of the hill slope provide congenial microclimate for quality production and minimises the incidence of insect pest and diseases thereby reducing expenditure on plant protection measures. Further, frost is a major problem for mango cultivation in subtropics and South-East aspect on hill slopes is considered better under frost situations.

S.No.	Fruit Crop	Name of Cultivar/Variety/Strain	Spacing(s)
1.	Mango	Pusa Arunima, PusaLalima, PusaShreshta, PusaPitambar, Arunika, Amarpalli and Malika	2.5 x 2.5 m

Crop Model VI. New fruit crops for warmer changing climatic situations:

Due to changing climate, rise in temperature and shifting of rainfall pattern has become a common phenomenon which need adapting mechanism for proper redressal of the situation. The difference between the day-night temperature i.e. diurnal variation in temperature of subtropical area with change in climate shall pave the way for cultivation of low chill temperate to tropical fruit crops. To develop crop production mechanisms for adaptation under changing micro agro-climatic situation, different high value low volume new fruit

crops / cultivars have been introduced viz., avocado, custard apple, coffee, jackfruit, carambola and macademia nut from different parts of the country.

New Tropical crops introductions in subtropics for changing climate		
1.	Sapota	Cricket Ball
2.	Avocado	TKD-1, Haas
3.	Coffee	Sln 5B, Sln-9 and Chandragi
4.	Custard Apple	ArkaSahan, Balanagar
5.	Jackfruit	Siddhu (High carotene flakes)
6.	Carambola	
7.	Macademia nut	

B. Hi-tech polyhouse for hi-tech Nursery production of fruit crops

Two number of hi-tech polyhouse of 288 sq. m covered area of each were constructed under the project where twenty thousand guava fruit plants (photographs) have been raised in the polybags. By this technique plants are ready for planting in the orchard site within one year irrespective adverse climatic variations and round the year. Under conventional nursery production system, nursery of fruit crops raised in the open field has poor survival percentage on farmer's field and it takes two years to raise saleable grafted plants. Hence, to increase survival percentage on farmers field and to save one year for raising grafted saleable plants, adoption of modern nursery production technologies is need of hour. More than 20 thousand genuine planting material of fruit crop have been raised in the interest of farming community.

C. Interactive Workshops/seminars/trainings for sensitization for field functionaries and farmers:

A training on organic and alternate farming system under changing climate in the subtropics was organized which was attended by 300 farmers from different districts of Himachal Pradesh. During the training farmers were sensitized for climate change and adapting mechanism to support crop planning over existing practices to minimise the impact of changing climate on crops growing in different agroclimatic situations by adopting organic farming or natural farming for the sustainability of the crop production system. The feedback from the farming community on existing crops and practices and their perception for climate change was acquired during the interactive training.

Sensitization of farmers and feedback from farmers and officer of Department of Horticulture(funding agency):

The field demonstrations on the developed technologies and crop models suitable for the regions were established at research farm of COHF-Neri. Where more than 3000 farmers were sensitized and exposed to adapt developed models in accordance to their suitability and situations.

In addition to this, the officers of developmental of state funding agencies were also provided hands-on-training on the developed crop modules to as buffering capacity under changing climate situations. This developed infrastructure is also being utilized to further scale-up the technologies and its application to other similar areas

D. Establishment of GIS research unit:

A state-of-art infrastructure facility has been created by establishing GIS Laboratory where advance GIS software i.e. ARC-GIS has been acquired and installed for data processing work. This facility has been utilized for generating information on area specific climatic fruit growing frost/non-frost after integration with the satellite data and historical weather data acquired from different sources so as to achieve the objective of remapping the subtropical region of the state. Postgraduate students of this college have been utilizing the facilities for their degree research programme working, This infrastructure has been used for teaching courses and practical study by the faculty of the college of Horticulture and Forestry, Neri.Weather data with respect minimum and maximum temperature and rainfall recorded by different agencies spanned over the subtropical areas of the state at different locations of of state has been procured from different Government agencies i.e. HAERC-Dhaulakuan, EVS-Nauni, CSKHPKVV-Palampur, RHRTS-Jachh, KVK-Berthin etc. This data has generated the understanding about the prevalent weather conditions which are useful for crop planning.
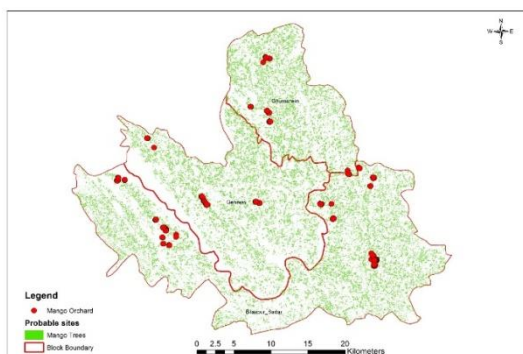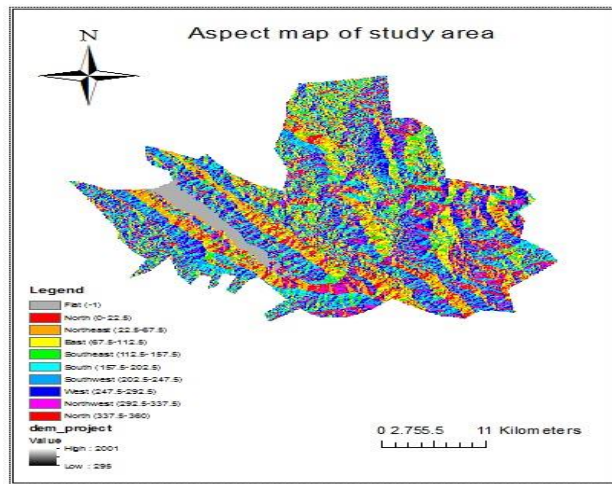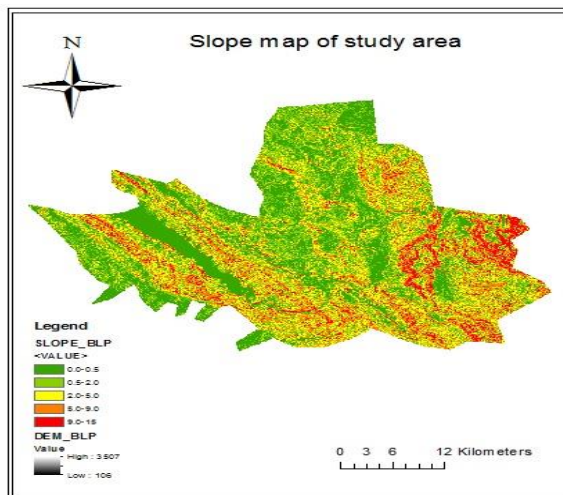

Figure 2. Mango plantation in District of Bilaspur

Slope map of study area

Legend
SLOPE_BLP
<VALUE>
- 0.0-0.5
- 0.5-2.0
- 2.0-5.0
- 5.0-9.0
- 9.0-15
DEM_BLP
Value
- High : 3507
- Low : 106

0 3 6 12 Kilometers

Aspect map of study area

Legend
- Flat (-1)
- North (0-22.5)
- Northeast (22.5-67.5)
- East (67.5-112.5)
- Southeast (112.5-157.5)
- South (157.5-202.5)
- Southwest (202.5-247.5)
- West (247.5-292.5)
- Northwest (292.5-337.5)
- North (337.5-360)
dem_project
Value
- High : 2001
- Low : 295

0 2.75 5.5 11 Kilometers

Geo-spatial data of different districts has been recorded along with actual ground situations for remapping of frost and non-frost location as well as diversity and variability in the specific locations of district wise like district Bilaspur and Una. The high resolution time scale ortho-rectified Cartosat-II and LISS IV data pertaining to the subtropical regions of the state have been acquired from the National Remote Sensing Centre (NRSC) Hyderabad to study the impact of climate change and effect of frost on different fruit crops which is helpful to detect the change in the cultivation pattern.

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