Bulletin on
Promising Technologies in Natural Resource Management for Temperate Regions

Volume I

ICAR-Central Institute of Temperate Horticulture
(Indian Council of Agricultural research)
Old Air Field, KD Farms, Rangreth-190007 (J&K)

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Compiled and edited by:
Anil Sharma
D.B. Singh
Shiv Lal
Geetika Malik
O.C. Sharma
J.I.Mir
W.H. Raja

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Natural Resource Management In Horticulture

Temperate horticulture is quite diverse in terms of fruits grown, the geographic position of the area, climate and topography as well as the orchardists who are involved in horticulture. So, natural resource management in horticulture is a critical component for horticultural producers for their long term survival in this field. Moreover, in order to address the environmental issues in horticulture, strategically, the natural resource management needs to be addressed first. Natural resources like land, soil and water, are the basis of horticultural production hence their proper utilization is important.

Horticulture has played a key role in ensuring the livelihood safety of farmers. For improving the productivity of horticultural crops in a sustainable mode, the natural resources need to be managed efficiently. A lot of research work has been undertaken in this regard and some important and effective technologies have been developed. These technologies, after location specific suitable modifications and refinements, need to be extended to the farming community.

By elevating efficiency and improving management of resource use, long term sustainability of horticulture can be assured. In this bulletin some of the important and promising technologies related to natural resource management in horticulture, with special emphasis to temperate regions, have been dealt and clubbed.

Technology-I

Technology Code: CITH/NRM/17/TECH-1

Name of the Technology: Despersible Vermi-pellet (DVP) preperation from aquatic waste/weeds/macrophytes

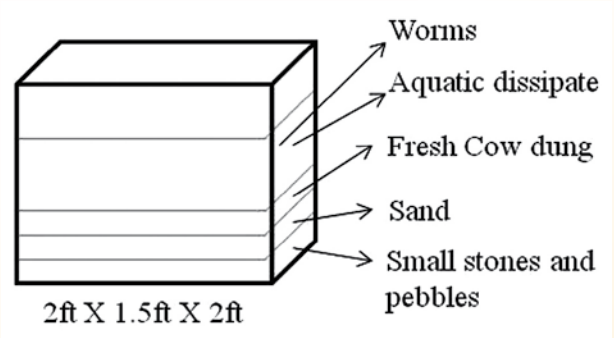
Area of applicability: All agro-climatic zones of India, but will give good results in fruit growing high hilly cold humid regions

Rationale: As a part of lake cleaning programme, various macrophytes, that include tall growing emergents *(Phragmites australis, Typha angustata)*, free floating type plants *(Azolla sp.)*, rooted floating leaf type *(Nymphoides peltatum, Nelumbo nucifera, Nymphaea sp.)*, submerged type *(Cerutophyllum demersum, Myriophyllum spicatum)*, are being removed as waste from the lake and are generally seen lying along the lake side.

These aquatic plants, otherwise wasted, can be decomposed and nutrients rich compost can be prepared from this dissipate. This nutrient rich compost can further be used to prepare some value added composting products that can prove to be beneficial for sustainable production of horticultural as well as agricultural produce. ICAR-Central Institute of Temperate Horticulture has developed a methodology to prepare nutrient rich dispersible vermi-pellets from the aquatic weeds through vermitechnology.

Technology description:

Vermi-pellets are prepared from the vermicompost prepared from the aquatic weeds. Vermicompost can be prepared in small scale at home or at your place in sufficient amounts as well as on large scale in



vermin pits or trenches Vermicompost can be prepared in small pots. On an average 20 to 25 kg of vermicompost can be prepared from a single average sized pot (6 cu ft.) pot. For vermicomposting we need a steel or plastic pot of 2t x 2t x 1.5ft dimension. The pot should have 3-4 holes at the base so that excess water if any may drain out. Inside the pot a 3 inches thick layer of small stones and pebbles is made. Over this first layer 3 inches thick (uniformly) sand is added. Over the sand a 3 inch thick layer of fresh cow dung is made. Over this layer earthworms are added. Generally in temperate conditions *Eisenia fetida* (earlier called as *foetida*) species of earthworms is used. While adding the Vermiculture be sure that equal proportion of adults, juvenile and cocoons is added as some times adults fail to acclimatize themselves to the new environment. Then the organic matter/waste or farm waste or aquatic waste is added. Here the proportion of Vermiculture and organic waste should be in the ratio of 1:15. Ensure that sufficient moisture is there. Earthworms need moist and warm conditions to carry their activities. Check moisture from time to time. The material inside the pot should be moist but not highly wet. Wait for around 90 days and the vermicompost will be ready.

For preparing enriched vermipellets following constituents are taken in proprtion given below:

A. Vermicompost
(Prepared from aquatic weed): 57%

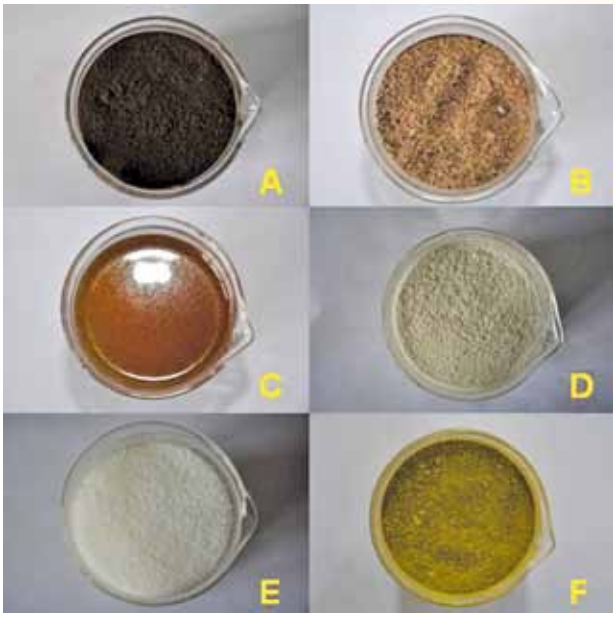
B. Grinded Neem cake: 30%

C. Mustard oil: 8%

D. Trichoderma: 2.0%

E. Dispersion gel: 2.0%

F. Grinded walnut leaves: 1.0%



All these constituents are grinded and mixed for more than 30 minutes. All the material prepared is then put in the shaking trey. The trey can be shaked mechanically as well as manually.

Shake the trey till the pellets of 2-5 mm size are prepared. Sieve these pellets from the 3 mm sieve. Separate the uniform pellets. Keep these pellets at room temperature for 24 hours and

then pack in poly bags. These vermi-pellets are dispersible in nature and starts dispersing as soon as these come in contact with water. The dispersion rate is given in the figure below. These vermipellets have following important properties:

-Dispersible

-Antagoniser for soil born diseases

-High in nutrients

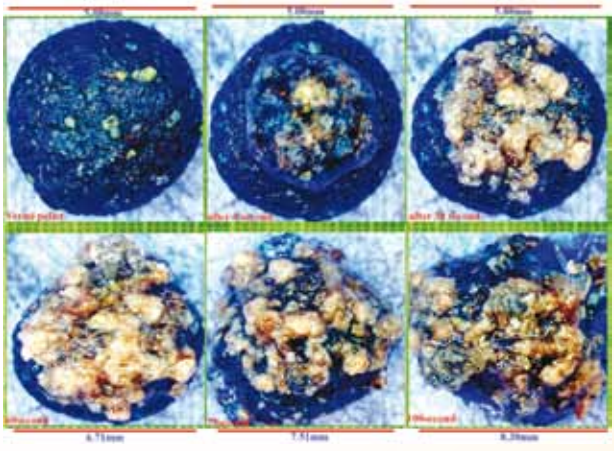
-Low CN ratio

-Slow nutrient release

-Total organic

-Controls weed

VERMIPELLETS

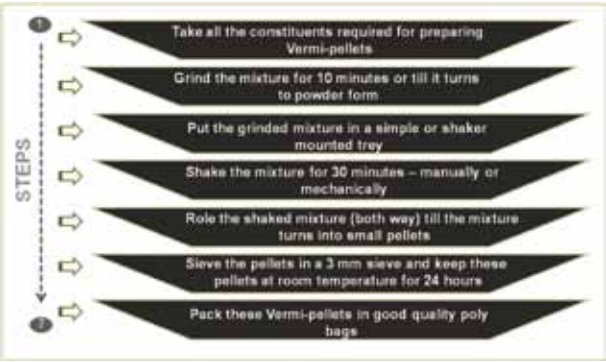


DISPERSION RATE
(Microscopic images)

Impact:

Testing of these pellets under field conditions is going on. Preliminary results have shown that these can effectively be used for perrineal crops. The use of these pellets is in testing phase at ICAR-CITH, Srinagar. Vermipellets will not only act as an organic source of nutrients in agriculture but its manufacturing will prove to be a commercial business to earn good amount of money.

Step diagram:



Anil Sharma, Shiv lal, Geetika Malik, O.C. Sharma, J. I. Mir, D.B. Singh, W.H.Raja and Sajad-Un-Nabi
ICAR-Central Institute of Temperate Horticulture (ICAR), K.D.farm, Old Air Field, Srinagar-190007 (J&K), India

Technology-II

Technology Code: CITH/NRM/17/TECH-2

Name of the Technology: Nutrient deficiency diagnoser and manager for apple (NDDMA)- A user friendly app.

Area of applicability: All apple growing areas

Rationale: Technology has always been a significant feature behind development as well as management. Even in areas where there is barely any development, technology seems to have transformed some part of it. In horticulture sector also there is a need of introducing advanced technologies to manage it efficiently. In apple growing areas especially in northwest Himalayas, farmers face difficulty in diagnosing the nutrient deficiency in their crop. They have to take samples with deficiency symptoms to the concerned departments, normally situated away from their orchards, to identify the nutrient deficiency and its further management. So ICAR-CITH, Srinagar has developed a mobile application in three languages which can not only diagnose the deficiency but can also suggest the correction measures of the same in apple crop at site.

Technology description: Disseminating horticulture associated information to farmers in the farming communities has become easier with the introduction of mobile apps. An important benefit of such apps is that it helps farmers make

better land management decisions. NDDMA is a user friendly mobile app designed by ICAR-CITH, Srinagar for apple growing farmers of the country. The app is designed to suggest management for curing nutrient deficiency in apple to optimize yield and to further reduce yield losses caused due to nutrient deficiency. The app is in three languages viz. English, Hindi and Urdu, common and dominating language of the apple growing areas of the country.

How the app works:

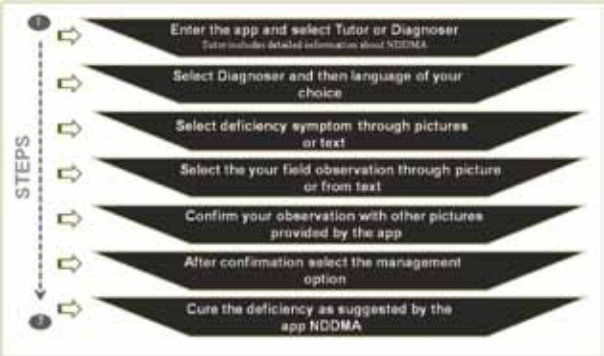
For starting the app enter the application, Select the option Tutor or Diagnoser. Tutor includes detailed information about deficiency symptoms and their management. In order to diagnose the deficiency, select Diagnoser. You will reach language selection page. Select language of your choice. Next page will give choice to select deficiency symptom through pictures or text. On selecting pictures you will reach the page displaying pictures showing nutrient deficiency. Select the picture as per your observation in the field. The app will provide some more pictures for confirmation. Here in this page management option will also

get displayed at top as well as bottom of the page. Select the management and cure the deficiency as suggested. If you want to select the deficiency through text, go back, select the option text. Select the text as per your observation and go for management. The app will be available at Andriod Play Store 24X7.

Impact:

The technology will have a significant impact and will be used by a large number of orchardists as is evident from the preliminary response of the apple growers. During the preliminary presentation of the app, farmers used the app and were ready to download the app as soon as it gets launched.

Step diagram:



Anil Sharma, Shiv lal, Geetika Malik, O.C. Sharma, J. I. Mir, D.B. Singh, W.H.Raja and Sajad-Un-Nabi
Central Institute of Temperate Horticulture (ICAR), K.D.farm, Old Air Field, Srinagar-190007 (J&K), India

Technology-III

Technology Code:	CITH/NRM/17/TECH-3
Name of the Technology:	Standarization of nitrogenous fertilizer placement mode, by exclusively designed *Desi Tungroo*, to optimize NUE and productivity in Saffron without polluting environment
Area of applicability:	Saffron growing cold humid region representing northwest Himalayas.
Rationale:	In order to get utmost advantage from fertilizers, especially nitrogenous fertilizers, they should not only be applied in proper time but in right mode too, particularly in high value crops like saffron. Different soils respond differently to different modes of fertilizer application. In saffron growing soils of cold humid regions of North West Himalayas fertilizer is generally applied through broadcasting method, which results in low nutrient use efficiency as well as leads to nitrate pollution. Keeping aforesaid fact in mind, proper mode of nitrogenous fertilizer application was standardized to get maximum returns from per unit fertilizer applied without polluting the environment.
Technology description:	After conducting series of experiments for more than five years, adept mode of nitrogenous application in saffron crop was identified. Experimentation revealed that best mode of nitrogenous fertilizer application in saffron is mid rib placement upper to the

corms in two splits. Here for developing this technology, related to mode of fertilizer application, nitrogenous fertilizer was applied through various modes viz: Broad casting, Band placement (using angular Tungroo) and foliar application. Band placement was carried out with two different modes- single sided and mid rib placement with single and double splits. In order to find out whether the depth of fertilizer placement effects the crop, placement of fertilizer was done in two depths i.e. parallel to corm and upper to corm. The placement was made with the help of Tungroo shown in the figure below. Treatment details along with their codes and yield data is given in the table below.

Treatment	Cumulative Pollution potential	Yield (kg ha^{-1})
C	-	1.16
B-1S	+++	1.44
B-2S	+++	1.45
BPSSP-1S	+++	1.38
BPSSP-2S	++	1.42
BPSSU-1S	++	1.61
BPSSU-2S	++	1.62
MRPP-1S	+++	1.78
MRPP-2S	++	1.80
MRPU-1S	+	1.83
MRPU-2S	-	1.92
FA-1S	-	1.53
FA-2S	+	1.57

Treatment	Cumulative Pollution potential	Yield (kg ha^{-1})
Treatment descriptions: *C: Control (No nitrogen); B-1S: Broadcasting 'One split '; B-2S: Broadcasting 'Two splits'; BPSSP-1S: Band placement single sided parallel to corm (BPSSP) 'One split'; BPSSP-2S: Band placement single sided parallel to corm (BPSSP) 'Two splits'; BPSSU-1S: Band placement single sided upper to corm (BPSSU) 'One split'; BPSSU-2S: Band placement single sided upper to corm (BPSSU) 'Two splits'; MRPP-1S: Midrib placement parallel to corm (MRPP) 'One split'; MRPP-2S: Midrib placement parallel to corm (MRPP) 'Two splits'; MRPU-1S: Midrib placement upper to corm (MRPU) 'One split'; MRPU-2S: Midrib placement upper to corm (MRPU) 'Two splits'; FA-1S: Foliar application (FA) 'One split'; FA-2S: Foliar application (FA) 'Two splits*		
Pollution potential descriptions *Maximum permissible limit (MPL) of Nitrate in ground water = 10 mg L^{-1}* "-" *Negligible polluting potential (≤10 mg L^{-1})* "+" *Very less polluting potential (>10 ≤ 14 mg L^{-1})* "++" *High polluting potential (>14 ≤ 20 mg L-1)* "+++" *Very high polluting potential (>20 ≤ 30 mg L^{-1})* "++++" *Severe/very hazardous polluting potential (>30 mg L^{-1})*		

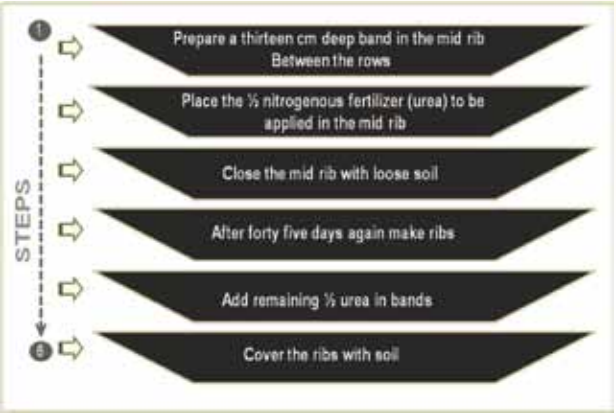
Tungroo with double sided lockable bar (a,b,c)

Tungroo with single sided lockable bar (d,e,f)

Impact:

This technology will have a significant impact on sffron growing areas as it will not only increase productivity but will help to get efficient use of nitrogenous fertilizer applications without polluting the environment.

Step diagram:



Anil Sharma, Shiv lal, Geetika Malik, O.C. Sharma, J. I. Mir, D.B. Singh, W.H.Raja and Sajad-Un-Nabi
ICAR-Central Institute of Temperate Horticulture (ICAR), K.D.farm, Old Air Field, Srinagar-190007 (J&K), India

Technology-IV

Technology Code:	CITH/NRM/17/TECH-5
Name of the Technology:	Standardization of doses of chemicals and training systems for minimizing skin russeting and enhanced fruit quality of nectarine
Area of applicability:	It can be adopted for all nectarine growing areas of hill states espacially Himachal, Uttarakhand, Jammu and Kashmir and parts of Punab
Rationale:	Skin russeting is major constarints in quality nectarine production. The fruit quality downgrade considerable proportion of a crop and such downgrading can seriously reduce profitability of nectarine production. In addition, enhanced rotting, and possible water loss, of russeted fruit in store can cause further economic loss. The technology shall be very useful for minimizing the skin russeting and helps in quality nectarine production with low input cost.
Technology description:	The technology was standardized on 6 years old nectarine cv. Fantasia budded on seedling and trained in different training systems *viz.* Tatura trellis, Four scaffold, Open Leader, Central leader system, Modified center leader system. The different concentrations and combinations of GA_3 and $ZnSO_4$ was prepared and foliar spay was applied at 10 days after fruit set and at active fruit development stage

View of nectarine experimental orchards

Untreated fruits in (a) central leader, (b) open leader and (c) four scaffold system

Treated with $ZnSO_4$ 200 ppm+ GA_3 50ppm in Tatura trellis system

(40 days after fruit set). Among the chemical treatments minimum russeting percentage was recorded in treatment $ZnSO_4$ 200 ppm+ GA_3 50 ppm as compared to control however, among training system in tatura trellis system as compared to other systems. For the minimizing fruit skin russeting in Fantasia nectarine pre harvest foliar spray of $ZnSO_4$ 200 ppm+ GA_3 50 ppm chemical was found suitable in the temperate region. Among the training system/canopy architectural structures, minimum fruit skin russeting in tatura trellis

system. Fruits with high TSS (^{o}B) was recorded in treatment GA_3 50ppm and maximum yield per plant was recorded in treatment $ZnSO_4$ 200 ppm+ GA_3 50ppm and in tatura trellis system as compared to control.

Impact:

Nectarine is a one of the potential fruit crop for crop diversification in temperate region. But fruit skin russeting is major hinderence in production of quality maretable nectaarine. The present standardized chemical concentration and training system shall be prove very useful for reducing fruit skin russeting under temperate climate. By using this technology fruit skin russeting can be minimized up to 20-25% as compared to control. The technology will be helpful in boosting the quality nectarine production in temperate regions.

Step diagram:

**APA:As per age (here 6 years)*

Shiv lal, O.C. Sharma, Anil Sharma and D.B. Singh
ICAR-Central Institute of Temperate Horticulture (ICAR), K.D.farm, Old Air Field, Srinagar-190007 (J&K), India

Technology-V

Technology Code: CITH/NRM/17/TECH-6

Name of the Technology: Standardization of chemical doses for minimizing fruit cracking in pomegranagte under Karewa condition of Kashmir valley

Area of applicability: It can be used for all pomegranate growing aras of hill states espacially Himachal, Uttarakhand and Jammu and Kashmir

Rationale: Pomegranate cracking in a major problem in all pomegranate growing regions and causes huge loss to farmers by reducing total yield up to 30-50%. It also deteriorates fruit quality significantly and fruit become unfit for marketing. Therefore the technology shall be useful in reducing the fruit cracking in temperate region.

Technology description: Experiment conductedon 8-years old five pomegranate varieties *viz.* Dholka, Bedana, Kandhari, Jyoti and G-137. The trees were planted at 2.5m ×2.5m and irrigation supplied by drip method @ 4 liter/hour at 4 days interval. Sixteen trees nearly uniform in shape and size and received the same pruning, training, weeding, intercultural operation etc. including the control. Calcium sulphate (2000, 3000, 4000 ppm), GA_3 (40, 80, 120 ppm) and Borax (25, 50, 75 ppm) and control (water) was applied as foliar application on 15th May (fruit set) and 15th June (fruit active development

Cracked fruits without treatments in Dholka, Kandhari, Jyoti and Bedana

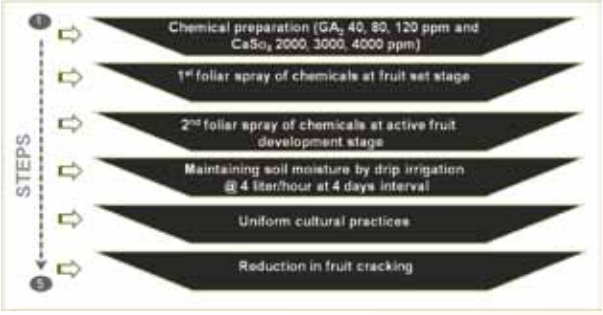
Oulaity and non-cracked fruits in Dholka and Jyoti treated with $CaSo_4$ 2000 ppm and CaSo4 3000 ppm

stage). At harvesting, fruit samples were taken from all trees in two seasons and the number of fruits per tree in each treatment was counted and the percentage of cracked fruits was recorded, also the fruit yield (kg) per tree was calculated. Calcium sulpahte 2000 ppm reduced cracking in Dholka, Bedana, Kandhari and calcium sulpahte 3000 ppm in Jyoti and G-137 at fruit set and fruit active development stages. Maximum yield per tree in cultivars Dholka, Bedana, Kandhari, Jyoti and G-137 could be achieved by foliar application of GA_3 80 ppm.

Impact:

Pomegranate is a one of the potential crop for fruit crop diversification in temperate region. But fruit cracking is most important hurdele after anar butterfly for succesful cultivation. The present standard chemical doses shall be prove very useful for reducing cracking in fruit under Karewa area of Kashmir valley which is characterized by low rainfall and high evapotranspiration. By using this technology fruit cracking can be minimized up to 22-25% as compared to control. The technology will help in boosting the quality pomegranate in temperate regions.

Step diagram:



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ICAR-Central Institute of Temperate Horticulture (ICAR), K.D.farm, Old Air Field, Srinagar-190007 (J&K), India

Technology-VI

Technology Code: CITH/NRM/17/TECH-6

Name of the Technology: Standardization of high density orcharding for peaches/nectarine under temperate climate

Area of applicability: It can be used for all peach/nectarine growing areas of hill states especially Himachal, Uttarakhand and Jammu and Kashmir.

Rationale: Traditionally peaches are planted in low density (6×6 m, 7×7 m) resulting low yield per unit area. In present scenario the natural and land resources are dwindling very fast and there is urgent need to opt the judicious and intensive peach production technologies. Although several factors such as climate, cultivar, rootstock, quality of planting material and cultural practices collectively affect the yield potential of fruit trees yet, the planting density is the most important which determine in increase in final yield. Information on the effects of tree densities on growth, yield and fruit quality is not well documented in the temperate climate of north-India. The current study was under taken with the objective to standardization of tree spacing and genotypes for growing peaches and nectarines in high-density orchards in order to increase fruit yield per unit area.

Technology description: The experiment was laid out in randomized block design with two factors i.e. planting

densities (2.5 m x 2.5 m and 3.0 m x 3.0 m) as first factor and four peach/nectarine varieties (Fantasia, Crest Heaven, Red Globe & Gloheaven) which were introduced from USA via NBPGR, New Delhi as second factor treatment with three replication. The planting was done during 2007-8 in the peach experimental field. The plants were raised under uniform growth conditions with timely cultural practices including drip irrigation and application of recommended doses of manures twice a year. Recommended NPK fertilizers were applied and appropriate plant protection measures were adopted as and when required. The plants started flowering during 2008 but fruit set was prevented by deblossoming in order to encourage optimum canopy development through training to modified central leader. The data of five years were pooled and analyzed by adopting standard procedures and interpreted using analysis of variance. Planting at spacing of 2.5x2.5 m plant to plant and row to row consisting 1111 plants/ha, gives the highest productivity however, fruit quality and yield efficiency was found better in 3 × 3 m irrespective of genotypes under temperate conditions.

View of plantation of nectarine at (3m x 3 m) plant spacing

View of plantation of nectarine at (2.5m x 2.5) m plant spacing

Impact:

The adopation of this technology shall be very useful for higher quality peach/necarine production. Beside this technology also save time and natural resources. The tall trees of normal density at high productive stage require heavy machinery and equipment for spraying of pesticides and crop harvest because outer tree canopy is the major fruiting area extending outwardly with the enlargement of the tree. High density orcharding appears to be the most appropriate answer to overcome low productivity and long gestation period for early returns and export quality fruits of peach/nectarine.

Step diagram

Shiv lal, O.C. Sharma, Anil Sharma and D.B. Singh
ICAR-Central Institute of Temperate Horticulture (ICAR), K.D. farm, Old Air Field, Srinagar-190007 (J&K), India