



## RESEARCH ARTICLE

## Case Study on Quality Banana Production in Tamil Nadu Part I : Pre-Harvest Factors that Influence the Post-Harvest Quality in Banana

E.Vadivel\*

Programme Co-ordinator (FPO), SFAC Ministry of Agriculture and Farmer Welfare, GoI, Former Dean (Horticulture) & Director Extension Education, Tamil Nadu Agricultural University, Coimbatore 641003, Tamil Nadu, India.

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### \*Address for correspondence

#### Dr.E.Vadivel Ph.D

Programme Co-ordinator (FPO), SFAC Ministry of Agriculture and Farmer Welfare, GoI, Former Dean (Horticulture) & Director Extension Education, Tamil Nadu Agricultural University, Coimbatore 641003, Tamil Nadu, India.

Email: systemsagri@gmail.com



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### ABSTRACT

Season of planting plays a major role in every crop and is the very critical factor for banana as it decides the productivity and quality of the banana fruits after harvest. The four standard seasons of planting banana in Tamil Nadu are summer (April to Mid-June), winter (Early November to Mid March), South-East Monsoon (June to September), and North-West Monsoon (October to December). . The banana festivals I, II, III and IV were organized to sensitize the producers and consumers in collaboration with CII, TN Chapter. All stake holders were brought under one roof for exchange of views based on their expertise. The case study was made to scout the real issue that checks the promotion of trade and market. The supply chain concept was well driven in the minds of all stake holders; How did the pre-harvest practices affects the postharvest quality of banana for distant and export markets were explicitly presented for deliberations so as to conclude the sessions of banana festival seminars with recommendations to policy makers, scientists, extension worker, trades and farmers for instant adoption.

**Key word:** Banana, Harvest, Cluster, Management, Production

### INTRODUCTION

CII and TN Banana Producers Company Ltd had initiated the processes for organizing the four editions of banana festival in Tamil Nadu and completed during the past four years with much focus on production of banana for value addition and export, which necessitates year-round production. Before IV the Edition of banana festival during 2017, a case study was undertaken to make an assessment of post-harvest management of bunches for better marketing as influenced by location specific cultural practices. The field survey was made and the realistic issues scouted have been highlighted during the festivals for deliberations by experts and stake holders



**E.Vadivel****Objectives**

- To study the Pre-harvest interventions for enhancing the Post Harvest management of banana at the three clusters identified in Tamil Nadu, viz., North West region, Central region and Southern region
- To understand the dimension and magnitude of processing, value addition and packaging systems done that can be at the farm level by the farmers and at scale level by the big business houses.
- To develop strategies for promotion of the branding and marketing approaches for commercialization of banana in TN.

**MATERIALS AND METHODS**

The three zones viz., North West Zone, Central Zone and South Zone with prominent potential for banana cultivation were identified. A total of 350 respondents were involved in the study comprising of 100 plus farmers from each of the selected clusters. Traders, exporters, researchers, academicians etc were also involved in the study. Data was collected through the questionnaire developed for the purpose, whetted by scientists of TNAU and NRC-B., Informal interviews were held with resource farmers, officials, bank executives; the fields were visited by the consultant team to understand the special operations. Digital and video documentation was made on the interviews, field visits etc. The processing units were visited and the details documented in detail. North west cluster is characterized by canal and well irrigation where 'Ney Poovan ' was grown predominantly for bulk marketing in Pune; Central cluster is unique in that several varieties like Poovan, Karpooravalli, Nadan, Nendran, hill banana and Rasthali are grown repeated for domestic market. Southern cluster is dominated by ethnic varieties and export varieties like grand naine and Cavendish; Th evariables includes season of planting, land preparation methods, types of irrigation, types of planting materials, plant protection, special practices like propping, bunch cover and foliar nutrition (Narayana CK and Pillay 2011)

**Source and type of information**

Primary data were collected through field visits & personal interviews from the farmers and others with well-structured interview schedules. Secondary data were gathered through other published media and official web sites. (Jaffer A.M and Namasivayam N 2005). The details gathered were updated in spread sheet for easy retrieval and analysis. The tables and charts were drawn to get the logical conclusions on specific issues of high light.

**RESULTS AND DISCUSSION****Season of Planting**

Season of planting plays a major role in every crop and is the very critical factor for banana as it decides the productivity and quality of the banana fruits after harvest. The four standard seasons of planting banana in Tamil Nadu are summer (April to Mid-June), winter (Early November to Mid March), South-East Monsoon (June to September), and North-West Monsoon (October to December). The choice of the farmers to choose the season is limited as it depends upon the onset of the monsoon, delayed or advanced, water level in the dams and reservoirs, wind velocity, humidity and temperature during the genesis of bunch at third month and shooting stages.

**North West Cluster**

Ney Poovan (Kathali) is the prime variety cultivated (90%) and Nendran and Grand Naine (10% each) are being the other two commercial cultivars. The planting season in this cluster is based on the market price at Pune.





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### **Strengths**

The produce receives a higher price in Mumbai / Pune market between February to April, which makes it a preferred planting season in the cluster.

### **Threats**

The major problem faced by the farmers is the high wind velocity during the months of August – September, which damages the crop extensively. Water scarcity during the summer months had brought down the cropping area to a greater extent in the cluster.

### **Central Cluster**

Poovan occupies the largest area in the cluster, followed by Karpooravalli and Rasthali. Other varieties like Kathali and Nendran occupy small areas. The planting season is chosen to avoid the crop damage due to high wind velocities during the months of July – August.

### **Strengths**

The produce receives a higher market price during the Aadi season so planting is done accordingly. The crop is less prone to wind damage and availability of water during summer is an added advantage.

### **Threats**

The bunch shooting stage coincides with the peak summer. So when the peduncle is not covered with leaves (Konnai Kattuthal), it gets exposed to direct sun and eventually the starts drying on the top side; The size of the fingers and the quality of bunches on the whole gets downsized due to constrained flow of metabolites. The bunching period is influenced by higher relative humidity, which makes plants prone for the higher incidence of pests and diseases. (Senthinathan S and Srinivasan R 1994)

### **Southern Cluster**

Poovan, Nendran, Rasa Kathali, Red banana and ethnic varieties are the commercially cultivated in this region. Since the cluster is predominantly canal irrigated, water availability from the Thamirabarani River is a crucial factor for deciding the season of planting. The unique feature of this region is that the planted crop is ratooned for 5 years to 7 years with regular yields. The question of season of planting is immaterial under such system.

### **Strengths**

The planting is completed by the mid of August and the water is available from the end of August. The season is also to get rid of the high winds that occur during the months of July – August.

### **Threats**

Water availability is for only 6 months in a year round planting is practically impossible for such canal irrigated lands.



**E.Vadivel****Major Constraints in Year-Round Production of Banana**

- i. Period of high wind velocity during bunch development stage (July – September),
- ii. Period of High temperature during bunching which results in drying of the peduncle (March – June)
- iii. Period of High humidity during the bunching stage which results in the increased incidence of pests and diseases (November – February)

**Land Preparation**

Banana being propagated through suckers and TC plants; the land preparation becomes a very important operation. Particularly the TC planting material requires a rich and well drained soil for better productivity. So it becomes very necessary to enrich the soil before plating the second banana crop. Land preparation includes tillage operations, crop rotation and the addition of organic amendments to enrich the soil and ensure larger corm size. The corm size at the time of shooting and bunch development enhances post harvest life of the fruits.

**Utilization of Previous Crop Residue**

The previous crop residue like organic inputs sustains the soil fertility and retains the soil texture and structure. If the previous crop residue is less, the soil compaction occurs at the cost of root growth which in turn affects the post harvest status of the hands. Crop residue is incorporated back into the soil in all the above-mentioned clusters. Once the crop is over, the crop residue is ploughed back into the soil with a used of rotavator. The crop residue being highly fibrous in nature, takes a long time to decompose thereby making it not useful for the current crop. The decomposition of the crop residue should be fastened by the inoculation of bio control agents such as *P. fluroescens*, *B. subtilis*, *T. viridie*, etc which decompose the residue as well as destroy the soil borne pathogens. The dried leaves of the standing crop can be used as mulching material, which serves to conserve moisture, maintain the soil micro-flora and on decomposition ads up to the organic carbon content of the soil.

**Type of Irrigation**

The soil moisture regime and soil air gradient decides the water and nutrient use efficiencies which ensure better post harvest life. In flood irrigation system, the soil moisture is raised to 100 % saturation when the air gradient is at level zero. The moisture regimes slowly comes down while the air gradient increases when soil starts drying leading to a situation when the moisture regime is zero and the air gradient is 100 %. This up and down swing of air and moisture regimes checks the flow of the metabolites both into the plant system and within the organs of the plant system when flood irrigated. When irrigated under drip system, the soil moisture regime and air gradient are maintained at a constant ratio of 60: 40 which supports abundant root proliferation and better yields coupled with high quality. Thus the type of irrigations is most strong deciding factor of post harvest quality of banana.

**North West Cluster****Strengths**

There is acute water shortage during the summer. Adoption of drip irrigation results in efficient use of water during such conditions and saves the crop from getting into water stress phase during the bunching stage





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### **Weakness**

Though 97% farmers adopt drip irrigation, fertigation is not carried out. Soil application and drenching with fertilizer solution is done manually, this consumes more labour increasing the cost of productivity.

### **Central Cluster**

#### **Strength**

The cluster is predominantly canal irrigated and the irrigation frequency ranges between 10 days to 30 days. The water availability is very good. Farmers in Thottiyam adopt drip irrigation accounting to 15% of the area in the total cluster. Out of which 1/3rd of the farmers (5% in the entire cluster) adapt fertigation

#### **Weakness**

High water availability during the bunching results in increased growth of the pulp is resulting in splitting of the fruits, decrease in the sugar content & low keeping quality due to high water content.

### **Southern Cluster**

#### **Strengths**

Though predominantly irrigated through canals, the cluster has 30% of its area under drip irrigation.

#### **Weakness**

The water availability for canal irrigated lands is restricted to only 6 months a year. This leaves the plants under stress during the bunching period, which affects the growth and the quality of the bunch.

### **Types of Planting Material**

The planting material is again a most critical factor to decide the post harvest quality of banana. Once over harvest or staggered harvest is dependant on the planting material ie suckers or tissue culture plantlets. The sourcing method and size of the corm are vital for sucker method. 100 % virus elimination is possible in TC planting material. Once over harvest and uniformity of bunches, hands and fingers are the virtues of TC plants.

### **North West Cluster**

Mettupalayam, Sathyamangalam, Sirumugai. Pedigree selection is possible. The suckers are sorted and graded before planting.

### **Central Cluster**

Cuddalore, Thoothukudi, Mettupalayam. The suckers are procured and sold by traders in truck loads in bulk. The quality of the sucker is not assured. Pedigree selection is not possible in most of the cases. The suckers are sorted and graded by size before planting.





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### **Southern Cluster**

Suckers sourced from nearby fields. Quality of the suckers is assured and pedigree selection is followed properly. The suckers are sorted and graded by size before planting.

### **Quality of Suckers and its Impact on Yield**

The quality of the suckers directly affects the yield in banana, Sword suckers weighing between 1.5kg to 2kg without any disease or nematode infestation should be selected, Smaller sized suckers result in slow growth and improper bunch development, Diseased or nematode infested suckers act as a carrier of the pest and infest the newly planted field.

### **Tissue Culture Plants**

#### **Bottlenecks**

The availability of TC plants in Tamil Nadu is greatly confined to Grand Naine. Other varieties like Nendran, Karpooravalli etc. are occasionally available or available based on the bulk order only; The cost of the TC plants is comparatively very high. Grande naine TC plants cost around Rs.12 – and Rs15 but for other varieties it is Rs.25 –Rs 30.00 each based on the variety, which makes it very costly compared to suckers which can be brought at a price of Rs.2.00 to 5.00 each (Hanumantharaya 2007)

### **Tissue Culture Plants**

#### **Special Care**

All the tissue culture plants should be planted in the same leaf orientation. This helps in the plants to shoot in the one direction, bringing in uniformity all over the field, which helps in easy intercultural operations. The nutrient requirement of the TC plants is also very high; since the plantlets enjoy WSF application under curing stage, so the plants should be fed with water soluble fertilizers immediately after planting to get the maximum yields

#### **Special Practices**

#### **Bunch Cover**

Covering bunches with banana leaves is an ancient practice in India. But this practice when did improperly results in scorching injury to the peduncle affecting the bunch development. Moreover this practice does not help in improving the visual appearance or the quality of the fruit besides safe guarding them from pests and diseases. Bunch covers are made from poly films or non – woven material and is widely adopted in Grand Naine cultivar. The following are the advantages of using banana bunch covers; Protection of the bunch from insect pests, birds & rodents; avoiding scorching or mechanical injuries to the bunch to a greater extent ther by resulting in the production of spotless banana; Advancement of maturity. The banana bunch cover was introduced in all the three clusters covered but the product turned out to be a failure due to various reasons, pricing being the most prominent out of them.



**E.Vadivel****North West Cluster**

The farmers first adopted the practice when the state government supplied it under 50% subsidy. Though it gave good results, the subsidy was withdrawn during the next planting season. The farmers did not buy it owing to higher price of the product.

**Central Cluster**

Few farmers had tried proper bunch covering and got good results. Some farmers tried this technique with locally available poly films with improper ventilation. The result was not so encouraging. Most farmers are misguided about bunch covers and do not try the technique at all. Farmers near Kulithalai and Mahadhanapuram report formation of hard lumps in Poovan increased when bunch covers were used in the summer;

**Southern Cluster**

The farmers of the southern cluster report that they are not able to see the maturity of the bunch visually when it is covered and end up harvesting them after getting ripened at the plant itself. Cost is another major issue which makes the farmers not to adopt this technique.

**Foliar Nutrition on Bunches**

Fertilizer application in banana is primarily through soil either with straight fertilizers or with WSF under drip and fertigation system. The fertilizers are to be applied in several split doses for the effective utilization by the plants. In Tamil Nadu, fertilizers are applied generally in 3 to 4 splits. There are differences among the clusters in dosage, method and stage of application. Foliar application of nutrients has great advantages over the conventional method. Since the bunch is the economical part, spraying of growth promoters, micro nutrients and yield boosters give an excellent result when applied through foliar sprays. Foliar application of GA, Sulphate of Potash, and Ferrous Sulphate are generally adopted. It is estimated that the plant utilizes 85% of the nutrients in foliar application compared to 40% (between 10% - 80%) when applied through the soil.

**North West Cluster**

The farmers generally adopt foliar spray of Sulphate of Potash. This stimulates the plant to shoot early and thereby significantly reduces the time taken for the maturity of the fruit. The grade of the bunch, size of the fingers and the overall bunch quality are improved through such application. Besides they are also addict to use commercial bio products of a particular company with out any basic knowledge about what exactly was the product.

**Central Cluster**

Only a few farmers adopt foliar spraying. Thottiyam belt, Thirukattupalli belt, Kulithalai belt are the places where foliar application is practiced regularly. In Mahadhanapuram and nearby areas, mixture of urea and neem oil cake or panchakavya is mixed and tied at the base of the bunch after shooting, . The farmers report that this practice improves the size of the fingers and brings uniformity in the development of the bunch.

**Southern Cluster**

Though the farmers spray pesticides regularly, the foliar application of nutrients is not widely practiced in the cluster.



**E.Vadivel****Propping Methods**

Supporting the banana plant to hold the bunch intact and safeguard it from wind damage using wooden or metallic poles is known as propping. Propping has to be done right after shooting for maximum protection. Propping is one of the costliest operations as far as banana is concerned. The investment into propping materials requires a high investment and it lasts for a period of 2 to 3 years only. Propping is predominantly done by means of wooden poles such as bamboo, casuarina, eucalyptus etc. Different types of propping methods are followed in Tamil Nadu. The selected clusters and the method of propping adapted there are given in the table below.

**North West Cluster**

The crop gets into the season of high wind velocity during the bunching stage and hence propping becomes necessary. The method adopted here predominantly is using plastic strip tapes. The plants are tied to each other by means of plastic strip tapes, which is fastened to a wooden or metal pole grouted into the ground. This method considerably saves a lot of cost compared to the wooden poles. However, during high wind velocities, the strip tapes get cut and the crops are damaged. Crop damage is also noted due to delay in adopting the practice. 30% of the farmers use wooden poles, especially casuarina or eucalyptus which are 12ft tall. The poles are kept inclined to the bunch from the opposite side after 1 month of shooting and tied at the peduncle portion. Care should be taken not to damage the peduncle while tying the rope. Though costly, the damage occurring due to high wind velocity is considerably low in this case.

**Central Cluster**

Propping is done with wooden poles. In most of the areas, the wooden poles are buried near the plant and the plant is tied to the pole. In this method, propping has to be done immediately after shooting and only thicker poles should be used. This increases the cost considerably. In some places in order to reduce the cost of propping, farmers use thinner poles. Propping is done 1 month after shooting in such a way that the pole rests to the peduncle from the opposite side, bearing the weight of the bunch.

**Southern Cluster**

Propping is not widely adopted owing to the negligible or nil crop damage due to the winds. The farmers provide propping only to the weak plants and to those that bear heavy very bunches. Propping is done with casuarina or eucalyptus poles.

**CONCLUSION**

The R& D efforts of National Research Centre for banana at Trichy, and Tamilnadu Agricultural University, Coimbatore had resulted in generation of potential technologies for improved yield and quality; there was no substantial promotion of banana trade. The banana festivals I, II, III and IV were organized to sensitize the producers and consumers in collaboration with CII, TN Chapter. All stake holders were brought under one roof for exchange of views based on their expertise. The case study was made to scout the real issue that checks the promotion of trade and market. The supply chain concept was well driven in the minds of all stake holders; How did the pre-harvest practices affect the postharvest quality of banana for distant and export markets were explicitly presented for deliberations so as to conclude the sessions of banana festival seminars with recommendations to policy makers, scientists, extension worker, trades and farmers for instant adoption. This case study was a pointer for farmers to take care of pre harvest production process for production of export quality bananas in TN.





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## REFERENCES

1. Hanumantharaya 2007 A comparative analysis of tissue culture banana production in Karnataka Ph.D diss, University of Agricultural Sciences, Dharwad.
2. Indian Horticultural data base 2013. National Horticultural Board, Ministry of Agriculture, Gol, Gurgaon, Haryana
3. Jaffer A.M and Namasivayam N 2005 Marketing cost of banana in Theni district, Tn Indian Journal of marketing 35(5)
4. Narayana CK and Pillay 2011. Fouteen post harvest processed products from banana in Banana Breeding: Progress and challenges pp 269
5. Senthinathan S and Srinivasan R 1994 . Production and marketing of Poovan banana in Trichirapalli district of TN, Indian Journal of Agricultural Economics 91) 46-53.

**Table 01: Seasons of cultivation of banana**

SI.No	Season	% of farmers in three banana clusters		
		North West Cluster	Central cluster	Southern Cluster
1.	March - April	100%	0%	0%
2.	June - July	0%	95%	0%
3.	July - August	0%	0%	100%
4.	Off season / Round the year	0%	5%	0%

The figures in the Table 01 shows the major seasons adopted by the farmers in the three clusters for planting of banana.

**Table 02: Utility of previous crop residue status**

S. No	Inputs	% of farmers in NW cluster	% of farmers in Central cluster	% of farmers in the Southern cluster
1.	Decomposed crop residue	0%	10%	10%
2.	Un-decomposed crop residue	100%	90%	90%
3.	No crop residue utilized	0%	0%	0%

**Table 03: Types of irrigation**

S. No	Type of Irrigation	% of farmers in NW cluster	% of farmers in Central cluster	% of farmers in the Southern cluster
1.	Canal irrigation	0%	80%	65%
2.	Flood irrigation	3%	5%	5%
3.	Drip irrigation	97%	10%	10%
4.	Drip irrigation & fertigation	0%	5%	20%





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**Table 04: Types of planting material**

S. No	Planting material	% of farmers in NW cluster	% of farmers in Central cluster	% of farmers in Southern cluster
1.	Suckers	90%	95%	80%
2.	TC plants	10%	5%	20%

Sourcing of suckers

**Table 05: Types of propping in banana**

S. No	Major constraints	% farmers in North Western cluster	% farmers in Central cluster	% farmers in the Southern cluster
1.	Plastic strip tapes	70%	0%	0%
2.	Wooden poles	30%	100%	10%
3.	No propping	0%	0%	90%

North West clust

