

**HIGH DENSITY PLANTING - A TECHNOLOGY FOR ENHANCED
PRODUCTIVITY AND PROFITABILITY**



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Preamble

Bananas and plantains are the fourth important staple food and is one of the richest sources of carbohydrates that provide energy (104 calories/100g) and are also equally rich in vitamins and minerals notably potassium, phosphorus and calcium and thus the crop as a food provides a more balanced diet than many other fruits. India is the largest producer of bananas with about 29 per cent in the global total production. The country has made steady and significant achievement in enhancing not only the area and production under banana cultivation but also the productivity of the crop increased significantly to compete with other major banana growing nations in the world. In India, bananas are commercially grown in the states of Tamil Nadu, Maharashtra, Gujarat, Karnataka, Andhra Pradesh, Telangana, Madhya Pradesh, Kerala, Odisha, Bihar, eastern U.P., West Bengal and Assam. Though the national average productivity of banana about 35-40 t/ha, the highest productivity of 65-70 t/ha has been made possible by the farmers of Maharashtra, Gujarat, Madhya Pradesh and Tamil Nadu. This could be attributed to the fact that large scale adoption of hi-tech cultivation practices of choosing tissue culture planting materials of high yielding varieties mainly the Grand Naine, adoption of high density planting techniques, drip and fertigation technologies and integrated nutrient management as well as plant protection measures.

ICAR-National Research Centre for Banana, Tiruchirappalli since its inception is striving constantly for the development of bananas and plantain in India. With its committed research efforts, the Centre has not only developed many innovative technologies to solve major concerns of the banana growers but also effectively disseminated those technologies for adoption by the farmers. This has made an impressive impact in solving some major problems plaguing the banana industry in the county. This is highly evident from the fact that production of bananas increased significantly to a tune of about 30.0 million tons from 0.83 million hectares as against a production of 16.4 million tons from 0.62 m ha hectare during the last decade.

High Density Planting and Fertigation

The High Density Planting (HDP) and Fertigation technologies developed by ICAR-NRCB have made a remarkable impact in promoting banana production and saving of water and nutrients. High density planting is normally understood as a system wherein a higher number of plants are accommodated in a unit area as compared to the conventional planting. In bananas, adoption of optimum density is very important for bridging the gap between the actual yield and the potential yield of banana from a unit area.

In order to mitigate the problem of getting low average productivity, the ICAR-NRCB has focused on increasing the plant population per unit area through modified high density planting systems of planting two or three suckers per pit and paired row planting system suitable for different varieties and agro climatic conditions. Besides, it also developed daily drip irrigation schedule as well as weekly fertigation schedule, INM practices including micro nutrients, mat and bunch management practices. Adoption of all these have resulted in enhancing land use efficiency, water and fertilizer use efficiency that ultimately resulted in increased productivity of quality bananas and the farm income as well.

In case of banana, optimum planting density is very important for bridging the gap between the actual and potential yield of banana per unit area. The details of the technology are tabulated below.

Plant population under different planting systems

S. No.	Method of Planting	Spacing (m)	Population (No. of plants/ha)
a)	HIGH DENSITY PLANTING Paired row planting system Dwarf varieties	1.2X1.2X2.0	5200
	Grand Naine, Poovan, Rasthali, Ney Poovan	1.5X1.5X2.0	3850
	3 suckers/hill (45 cm apart in the pit)	1.8m X 3.6m	4600
b)	Grand Naine, Nendran, Rasthali	1.8m X 3.0m	5550
	c)	Two plants per hill (Ney Poovan, Poovan, Rasthali, Nendran, Monthan)	2.1m X 2.4m
		2.1m X 2.7m	3960

Under this technology, with the adoption of three suckers per pit at a spacing of 1.8 x 3.6 m about 4600 plants/ha or two suckers per pit at 2.1m X 2.4m or 2.1 X 2.7m about 3525 plants and 3960 plants/ha were accommodated respectively. Similarly, in 'paired row planting system' higher plants population was maintained with a spacing of 1.5 x 1.5 x 2.0m or 1.2 x 1.2 x 2.0 m about 3850 to 5200 plants/ha could be accommodated in depending on the varieties and prevailing soil and climatic conditions.

Water requirement of banana through drip at different growth stages

Sl. No.	Crop growth stage	Duration (weeks)	Quantity of Water (lit./plant)
1.	After planting / Ratoon	1-4	4-6
2.	Juvenile phase	5-9	8-10
3.	Critical growth stage	10-19	12
4.	Flower bud differentiation stage	20-32	16
5.	Shooting stage	33-37	20 and above*
6.	Bunch development stage	38-50	24 and above*

Weekly fertigation schedule for banana (g/plant/week)

Weeks after Planting	Urea	Total (g/plant)	MOP	Total (g/plant)
9 to 18 week (10 weeks)	15	150	8.0	80
19 to 30 week (12 weeks)	10	120	10	120
31 to 40 week (10 weeks)	7.0	70	12	120
41 to 46 week (5 weeks)	Nil	Nil	10	50
Total	----	340	----	375

High density planting combined with drip and weekly fertigation techniques resulted in better input use efficiency and saving of 30-40% irrigation water and 25% fertilizers as compared to conventional method. This resulted in increased production, productivity and fruit quality with reduction of cost of cultivation.

Demonstration of these technologies in farmers' fields caught the attention of large number of farmers and now several farmers from near and far are visiting ICAR-NRCB to have first-hand information about the technology and are adopting the same to enhance their income. The HDP technologies such as planting of two or three suckers per pit and paired row planting has widely been adopted by the banana growers across the country. Commercial banana cultivars *viz.*, Grand Naine (AAA), Nendran (AAB), Ney Poovan (AB) and Rasthali (AAB) are being grown under high planting system with good success and enhanced income to the farmers in Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Maharashtra and Gujarat, etc. Owing to the advantages of HDP system, the area under HDP in different banana cultivars is steadily on the rise.



Modified HDP in Nendran banana - Planting three suckers per pit

The advantages of the technology which made its adoption easier are as follows:

- Accommodation of more number of plants/unit area.
- Less initial investment on drip system because of wider spacing and easy fertigation.
- Reduction in the cost of cultivation through minimal efforts for clump management.
- Saving of irrigation water (30-40%), fertilizers (25%) and plant protection chemicals.
- Adjacent plants protect each other and avoid damage from wind with medium velocity.
- Significant reduction in staking cost (3 plants are tied using a single rope).
- Enhanced fruit quality with 40-50% increase in productivity.
- Ample scope for inter cropping in the wider inter row spacing and reduced weed growth.

Doubling of income through double suckers per pit in banana cultivation - A success story of Farmers' Experience with High Density Planting System in Banana

Farmer: Shri. K. V. Senthil Kumar, S/o T. Vallimanavalan,
113B, Chidambaranar, Kavery Nagar, Kulithalai, Karur

The HDP of two suckers per pit was demonstrated in farmers' fields in Karur and Tiruchirappalli districts of Tamil Nadu and this highly successful technology become more popular among the farmers. Much satisfied with the success of the technology many farmers adopted this technology with ease and lots of interest. Initially, with the support of ICAR-KVK, Karur the technology was adopted by Shri. K. V. Senthil Kumar, a traditional banana grower from Kulithalai Taluk, Karur District in Tamil Nadu in Karpuravalli banana (syn.

Pisang Awak) in three acres. Inspired by the encouraging results and additional yield and income obtained, he planted NeyPoovan (syn. Elakkibale), Poovan (syn. Mysore/Palayankodan/Champa) and Karpuravalli bananas in three and four acres respectively and got higher yield and additional income from all these varieties.

By adopting the HDP system of planting of two suckers per pit, the farmer could plant 1250 suckers and 1600 suckers per pit as against 700 suckers and 900 suckers under conventional system in Karpuravalli and NeyPoovan bananas respectively. In Karpuravalli banana, the farmer harvested a total of 3200 bunches from three harvests in 30 months period and realized a net profit of Rs. 3.80 lakh as against the net profit of Rs. 2.20 lakh under the conventional planting system of single sucker per pit. Reduced wind damages and reduction of weed growth are the other advantages experienced by the farmers under the HDP system. Similarly, more net profit and lesser weed menace and wind damages were experienced by other farmers in Ney Poovan and Poovan bananas grown under HDP system.

Subsequently, a field day was organized in collaboration with local KVK, NABARD and District Lead Bank and where the technology was demonstrated to many farmers. As a result, the area under HDP of banana has reached 150 acres in Trichy alone and being adopted in commercial varieties of Karpuravalli (ABB), Ney Poovan (AB), Poovan (AAB), Rasthali (AAB), Nendran (AAB) and Monthan (ABB), a cooking banana.



Field demonstration and on-farm training for easy understanding and better adoption

Adoption of Modified High density planting in banana cv. Nendran under Kerala conditions

In association with the ICAR-KVK, Ernakulam District, Kerala, the modified HDP technology was initially demonstrated in one acre land in Ernakulam district. The farmer who got benefited through the technology stated that under the HDP system the cost of production per plant was significantly reduced to Rs. 50 per plant as against a cost of Rs. 80 per plant under conventional system of cultivation. Moreover, the productivity was more than double with a total yield of 38 tons/ha while under conventional system the productivity was just 17 tons/ha. The impact is such that the convinced with the success of the technology, more farmers started adopting the HDP technology and thus about 15 acres was covered under HDP technology and the area is steadily on the rise.