

Welcome Banana in the traditional rice-potato cropping system of Purba Burd

A study was focussed to provide the best alternative to the farmers of Purba Bardhaman, West Bengal who are habituated to trail only rice-potato cropping system. Unremitting monoculture followed by everyone generates several issues like a marketing problem, not to fetch optimum value for the product, etc. Moreover, excessive dependence upon a single crop increases the chance of cumulative crop failure due to natural calamities. To address these problems, a survey was conducted and we came up with an idea for banana cultivation. But before suggesting it to the farmers, a research trial was laid out at Teaching farm, College of Agriculture, Purba Burdwan, BCKV to perceive the performance of bananas in this region. Whilst, we adopted GAP, recorded observation on the disease-pest situation and remedial measures were taken timely. Ultimately, we harvested a good yield for the two consecutive years, and the cost-benefit estimated 1:1.50 which gives us the confidence to encourage the farmers of Purba Burdwan for banana cultivation.

BANANA is an economically important fruit not only in India but also throughout the world. This fruit exerts immense influence on the socio-economic, customs, trade, and traditional values of India as well as in Asia. India is leading in banana production in the world by sharing 29.19% of total production. Major banana-producing states are Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh, and Karnataka. Despite having potential, banana cultivation in West Bengal (WB) has been restricted only in the few pockets of Murshidabad, Nadia, and Darjeeling district. It is the second most popular fruit in WB after mango, with high nutritional value. Present agriculture scenario compelled us to adopt crop diversification, bring about changes in the productivity so the farmers can earn more benefit from the same piece of land, whereas even the progressive peasants of Burdwan, which is also known 'Rice bowl' of WB, confined themselves only rice-potato cultivation system. Every year the fate of the growers is determined by the ever-fluctuating market price of the commodity that fails to offer the expected income for them. This issue can be addressed best by approving an alternative cultivation option along with the existing one. Banana could be one of the best choices considering its high market demand and exploring the fact that it's not been yet cultivated commercially in Purba Burdwan district though one banana ripening center is nearby in Durgapur city. The reason behind selecting banana over any other crop is once planted it will give production for at least three continuous years and due to high demand in the market through the year-round, therefore, marketing will also not be the problem. Moreover, if any issues arise

after planting or in between then replacement of the crop is also possible any time, unlike other fruit crops. Keeping all this in mind, an experiment was undertaken to perceive



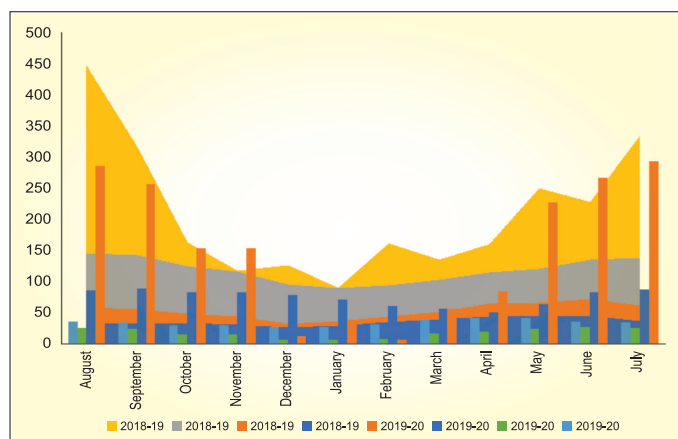
Full grown banana bunch

the effect of prevailing weather of Purba Burdwan on banana cultivation. Data recorded on yield performance and B: C ratio was calculated. Additionally, the record was kept on disease and pest appearances and suitable management strategies were adopted.

Cultivation procedure

Location: The experiment was laid out at the Teaching Farm, College of Agriculture, Burdwan, an extended campus of BCKV. The place lies between Lat: 22.930 N, Long: 88.550 E, and altitude: 36 m MSL. Soil type is loamy sand and pH 7.2. Inside the farm, a comparatively high piece of land about 1000 m² was selected. The experiment was started in the year 2018.

Weather details during experimental period i.e 2018-19 and 2019-20



Planting material: Here, we preferred the G9 tissue culture banana. It belongs to the ‘Cavendish’ group and the fruits are very attractive according to their colour, fragrance, and size. Moreover, the height of the plant does not reach too high (around 6 feet) and therefore, it’s been advantageous to protect the crop from stormy weather. Further, being tissue cultured all the plants mature at the same time thus also uniformity in fruiting is realized. The best thing about the “G9 tissue culture” banana is it can give up to 3 crop harvests within 27 months whereas other banana types give only two and the time of first fruiting is

Table 1. Manuring schedule for G9 tissue culture banana for Purba Burdwan, West Bengal

Time of application	Fertilizer	Amount in gram per plant
30 days after planting	Urea	25
	SSP	100
	MOP	50
	Micronutrient mixture	2
60 days after planting	Urea	50
	SSP	100
	MOP	50
90 days after planting	Urea	65
	SSP	100
	MOP	50
	Micronutrient mixture	2
120 days after planting	Urea	65
	MOP	100

also less. First fruits come after 11 months and then the next crop could be harvested at an interval of 8 months only.

The saplings were planted in the month of September just after the rain but the best time of planting is February-March if irrigation facilities are available. It will increase the chance of getting a maximum price from the product as the fruits mature during winter when the demand remains higher than the supply.

Land preparation: Before planting, land was deeply ploughed twice at 15 days interval during hot summer and kept open for one month. Then furrows were opened by using a spade and on the ridges, wholes were made at a distance of 1.8m to 1.8m. Wholes were of minimum 1-foot depth and filled with 10 kg vermicompost along with 50 g SSP and 5 gm MOP and 10 gm of granular insecticides. Besides this, during the preparation of the main field, we had applied FYM @ 2 tonnes per 1000 m² along with *Trichoderma* and *Pseudomonas* 1 kg each and 2 quintals of neem cake.

Precision farming technology in banana

Fertigation of 75% N, P₂O₅, K₂O (derived from STCR equation) along with irrigation at 80% ER and polyethylene mulching (100 µ thickness) in combination with foliar spray of (2%) micronutrient Banana Shakti (at fourth, fifth and sixth MAP) and bunch spraying with 2% potassium sulphate (once at male bud removal and again 30 days later) significantly enhanced the yield of banana cv. Grand Naine in Karnataka, Odisha and Andhra Pradesh. The yield enhancement was to a tune of 22 to 44% with B:C ratio of 2.78 to 3.37. The treatment can also significantly advance the harvest by 28 to 40 days, besides improving the fruit quality with respect to TSS and shelf life.

Source: ICAR Annual Report (2020)



Banana field



Initiation of banana inflorescence

Manuring schedule: Tissue culture banana requires extensive manuring. It has a high capacity to uptake nutrients from the soil as well as can efficiently convert that uptaken nutrient into production. This is why the following manuring schedule (Table 1) was followed and havoc yield received. From the next 30 day intervals,

only Urea and MOP were given @ 30 gm and 60 gm respectively continued up to 300 days after planting (10 months).

Other cultural operation: Tissue cultured banana needs special care from the beginning and we did it thoroughly. Besides manuring, timely weeding and watering was also

Table 2. Information on diseases and pest

Name of the diseases/ Pests recorded	Symptoms	Time of appearances	Management practice adopted
Panama wilt or Fusarium wilt	Conspicuous wilting symptoms i.e yellowing of the leaves (lower most showed the symptom first), extend upward. Leaves break easily and hang down. Upon splitting of the pseudostem brown discoloration of the vascular bundle observed.	September-October	Systemic fungicide Foselty-AL (organophosphorus group) was used as soil drenching. Recommended dose of the chemical was used for thrice. The chemical has both acropetal and basipetal movement that arrest the growth of the fungus in its active vegetative and spore formation stages. Moreover, if it is used as prophylactic spray it helps to boost up the plant immunity system that act as save guard against other diseases in future.
Cercospora leaf spot	Spindle shaped spot with greyish centre with yellow halo running parallel to veins.	Feb-March	Removal of the leaf just after first observation. Then sprayed chlorothalonil @ 2 ml/L twice
Anthrachnose	Small, circular, black spots develop on the affected fruits. At the initial stage dark brown patches on immature fruits. Severe infestation may leads to shrivelled and black coloured rotten fruits.	June-July	Initial infection started but as we covered the whole bunch with gunny back it prevents the further spread of the spores thus new infection.
Banana stem weevil	Presence of small pinhead-sized holes recognised on the stem. Exudate comes out from the infected. Tunnel form in the leaf sheath and inner core of the stem.	March-April	Stem injection with Monocrotophos @0.05%.
Banana Thrips	Scrap the attacked organ and render them brown discoloration especially leaves and young fruits. Reduce plant vigour and poor-quality bunch produced.	June-July	Sprayed Monocrotophos @0.05%

done. At the time of the first top dressing, soil earthen up at the base of the plant to provide support. Additionally, bamboo staking was done at the time of the fruit set so that the plants did not topple down by the weight of the fruits. As the most critical time of irrigation is the flowering and fruit formation so, special attention was given during that time so as to not hamper production.

Just after the appearance of the first bunch of bananas, the whole spike was covered with the gunny bag to protect the fruits from the scorching heat to help the fruits to keep away from several insect pests and also from the air-borne spores of the fungus resulting in clean and scarless fruits that increase the market value. But before covering, always remove the flower remnant from the tip of the spadix and it should not be practiced during the rainy season.

Only one healthy sucker was allowed during the first year and for the next subsequent two years also only one sucker was permitted.

Disease and pest prevalence: Information regarding the appearances of diseases and the pest in accordance with the prevailing weather condition was recorded. Though it was tissue cultured plant and only the healthy disease-free saplings were chosen for planting but, the chances of getting attacked by several pathogens or pests could not be ignored depending upon their presence in the soil, air, or in the neighbourhood.

It is worthy to be mentioned here that proper planning before implementation of the project would help to keep the disease and pest away naturally. For example, starting from the selection of land (upland chosen) and saplings planted in ridge helped to avoid water logging conditions (defend the attack of several pathogens), soil solarization practiced (reduce the potential inoculum load in the soil), selection of healthy saplings, use of plenty organic manures, application of Trichoderma and Pseudomonas, neem cake, granular insecticides at the time of planting facilitated to save the crop from the attack of pests and pathogens. Furthermore, timely application of every possible measure like weeding, fertilization, on-time irrigation, and regular survey of the field helped us for early detection and diagnosis of the diseases and pests and

to take up precise protection measures that would keep the infection under control and gave a healthy crop stand.

Yield: Height of each plant was 6 ft. whereas the length of the spike was approx. 3 ft. During the first year, the number of hands per spike was 9-10 and the number of fingers was 20. Therefore, the total number of bananas received per plant was 200-220.

During the second year, the yield received was higher than the first year. The total number of hands per spike was 12-13 and the number of fingers was 25-27 per hand. Mostly higher number of hands produced in the upper portion of the bunch and total banana harvested 250-270 per bunch.

Economics: Yield obtained converted into tonne per hectare. The average per hectare production of bananas was 50 tons following the package of practices as discussed here. Considering the current prices, the gross value of this product is around ₹ 300000 per hectare and the profit from banana cultivation came to around ₹ 100000. The cost of production per tonne was calculated at ₹ 4000 while the price received by the producer came to ₹ 6000 per tonne. Thus, the price received by the producer not only covered the cost of production but also left a substantial margin of profit to the producer. The benefit-cost ratio which indicates the profitability of investment was worked out to 1.50 indicating thereby banana cultivation is highly profitable.

It could be concluded from the research findings that banana cultivation holds high potential in Purba Burdwan and the surrounding area. If the farmers chose bananas along with the existing crops it will not only back them financially but also introduce crop diversification that will gradually obliterate their dependency on a single crop and the chance of total crop failure will get abridged.

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Organic farming in banana

In Grande Naine banana, the application of poultry manure + groundnut cake + rural compost + wood ash + VAM + PSB + KSB yielded bunches (23.5 kg) which were on par with with 100% inorganically fertilized banana plants. The nutrient uptakes (g/plant) and the leaf nutrient concentrations of organically grown banana were also on-par with 100% inorganically fertilized crop. The organic inputs caused decline in soil pH from 8.2 to 7.2, increased EC (dS/m) from 0.21 to 0.23 and organic matter from 0.12 to 0.72%, at harvesting. The organic banana grown soil had good number of CFUs of Actinomycetes (713×10^1), fungi (45×10^2) and bacteria (153×10^3). The B/C of this best treatment was 1.9 against 2.8 that of inorganic fertilizer alone. The 'r' values for soil available nutrients indicated a significant matching of nutrient releasing and uptake patterns in organic banana farming.

Source: ICAR Annual Report (2020)