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HIGH PRODUCTION TECHNOLOGY (HPT) IN BLACK PEPPER

Black pepper *(Piper nigrum* L.) the King of Spices is the major export earner among the various spices grown in India. It is cultivated both as monocrop and also as mixed crop in coconut and arecanut based farming systems in Kerala and Karnataka States. About 97% of India's production is contributed by Kerala State out of which, the major share comes from small and marginal farmers.

As per the area and production statistics (1987-88) the total area under this crop in India is 1,58,000 ha with a production of 49,000 tonnes. The export earnings during 1987-88 was over Rs. 2,400 million which highlights the importance of the crop among the spices. The productivity of black pepper in India is the lowest in the world eventhough India has the largest area under this crop. (Table 1)

GLOBAL DEMAND

The global demand of black pepper by 2000 AD was estimated as 1,85,000 tonnes. In order to capture atleast 50% of global market India should increase its production from the present level of 49,000 tonnes to 1,22,500 tonnes which include 30,000 tonnes for internal consumption. This is possible by overcoming the different production constraints.

PRODUCTION CONSTRAINTS

1) The poor genetic base of the existing vines and the preponderance of unproductive, old and senile plantations.
2) Non-availability of quality planting material.
3) Non-adoption of scientific management especially nutritional and plant protection aspects.

Table 1. *Area, production and productivity of black pepper in the major producing countries (1986–87)*

Country	Area (ha)	Percentage	Production (tonnes)	Percentage	Yield (kg/ha)
Brazil	16,000	6.3	25,300	20.4	1580
India	136,620	54.1	32,850	26.6	240
Indonesia	80,000	31.7	37,000	29.9	460
Malaysia	5,262	2.1	15,500	12.5	2925
Madagascar	6,200	2.5	2,800	2.3	450
Sri Lanka	6,500	2.6	2,700	2.2	415
Thailand	1,834	0.7	7,568	6.1	4200
Total	252,416	100.0	123,718	100.0	490

4) Crop loss due to diseases and pests and the highly fluctuating weather conditions.

5) The unstable market prices.

6) The poor-socio-economic status of the small and marginal farmers and lack of adequate credit facilities and

7) Inadequate transfer of technology services

CONCEPT OF HPT

Since the scope for increase in the area is little, immediate alternative is to increase the productivity of black pepper per unit area. National Research Centre for Spices (NRCS) in its endeavour developed a viable High Production Technology based on the agrotechniques developed at this centre.

Being a perennial crop the total development of black pepper can be achieved only in a phased manner. There is enough evidence to suggest that the present productivity level can be increased to more than 4-5 times by the adoption of the high production technology. This publication gives the results of the large scale demonstration programmes undertaken by the National Research Centre for Spices in the farmers' fields.

GENERAL PROFILE OF THE PROJECT AREA

Bench mark survey

A bench mark survey was conducted during March, '86 in three villages *viz.*, Pannikottur, Peruvanna (Peruvannamuzhi area) and Puthuppady in Calicut district to collect the information on the size of the holdings, cropping systems, type of standards used to trail pepper, practices adopted, productivity of the crop, marketing and credit facilities available. Based on these informations 51 gardens were selected for demonstrating the high production technology at Peruvannamuzhi where black pepper is cultivated as mixed crop in coconut|arecanut gardens and at Puthuppady where pepper is grown as a monocrop. Out of 24,400 vines in these holdings 13,400 were kept as experimental and the remaining under the usual farmer's practices.

Climate and soil

The area falls in 5th of the 12 agro-climatic zones of Kerala and is of warm humid type. The mean annual rainfall during the present study was 4000 mm received in 126 rainy days. About 70% of the rainfall is received during South West monsoon. The area experiences a dry spell of almost 6 months from December-May. The mean maximum temperature was 38°C and minimum 21°C. The average humidity was 81%.

The soil type is lateritic, reddish brown in colour, sandy clay loam in texture, acidic in reaction, medium in nitrogen status, poor in phosphorus and poor to medium in potash and low in manganese and zinc status.

Farm holdings|farming practices

Among the farmers, 25% were marginal, 59% small and the remaining 16% were large. The density of population of pepper was 300 vines|ha. The bench mark survey revealed that 12% of the farmers were not applying manures to black pepper, while 14% alone were using inorganic fertilizers. About 18% used fungi-

cides for disease control while 50% were using insecticides against 'pollu' beetle infestation. Organic manures were seldom used though mulching pepper basins was practiced by a few.

Cropping system

The main crops are coconut, arecanut, banana, black pepper, ginger and turmeric. Besides, fruit trees like mango and jack are also grown on which black pepper vines are trailed. *Erythrina indica* is the most popular live standard used to trail pepper.

Black pepper varieties grown

From the varietal distribution in the Transfer of Technology Centres (TTC), it is noticed that 49% of the total vines was of Karimunda cultivar followed by Panniyur-1 (28%). The other varieties include Arakkulammunda (14%), Narayakodi (5%), Kuthiravally (1%) and unclassified varieties (3%). Karimunda cultivar is the popular cultivar grown in the experimental area.

At Pannikottur and Peruvanna, majority of vines were in the age group 2-7 years and were trailed on *Erythrina,* as mixed crop in coconut and arecanut gardens and also on mango and jack. At Puthuppady, the majority of the vines were in the age group of 10-15 years, grown as pure crop trailed on *Ailanthus malabaricus* (Matty)

IMPLEMENTATION OF THE HIGH PRODUCTION TECHNOLOGY PROGRAMME

The HPT programme was implemented during 1986-'89.

Technologies transferred

* Adoption of phytosanitary measures in black pepper gardens to check disease incidence.
* Replanting of black pepper gardens with high yielding elite lines.
* Balanced nutrition.
* Adoption of timely plant protection measures.
* Cultural operations such as shade regulation, mulching pepper basins etc.

Inputs supplied

Based on the bench mark survey, the input requirements for individual vines were worked out. The inputs supplied by NRCS were (1) Healthy and high yielding, rooted pepper cuttings (2) organic manures like neem cake and bone meal, (3) inorganic fertilizers (4) fungicides and insecticides (5) sprayers and (6) Technical literature in Malayalam. The expenditure on farm yard manure|compost and the labour input were met by the farmers. The financial contribution by the NRCS and the farmers was in the ratio 1:2.

Advisory committee

An advisory committee consisting of Scientists from NRCS, officials of State Departments, Development Agencies and Bank officials was set up for the implementation and monitoring of the programme. The committee met at every quarter and reviewed the working of the programme and suggested improvements.

Training

The farmers were given pre-season training at NRCS Experimental farm, Peru-

vannamuzhi on the various aspects of HPT programme. For this the farmers were divided into seven groups and each group consisted of a group leader who worked as a liaison agent. The training was imparted on cultural operations like the adoption of phytosanitary measures, and application of fertilizers and pesticides. The method of processing black pepper by dipping green pepper in boiling water for one minute before drying, was also demonstrated. Leaflets on calendar of operations (Annexure-1) were supplied to the farmers.

IMPACT OF THE PROGRAMME

The productivity of the vines after the implementation of the HPT programme increased by 209% at Peruvannamuzhi while an increase of 303% was recorded at Puthuppady during 1986-87 (Table 2) might be due to the narrowing down of the gap between the productivity of control and experimental vines.

The nutrient analysis of the soil samples in HPT plots revealed a substantial increase in the build up of soil nutrient, compared to the control plots due to addition of inputs. (Table 3)

Incidence of foot-rot and slow decline disease was decreased considerably. (Table 4) Timely insecticide sprays controlled 'pollu' beetle infestation.

The average cost of inputs applied under the HPT programme including labour charges worked out to Rs. 10|vine. The additional return obtained by an average increase (mean of 4 years) 685 gms of black pepper under the mixed cropping system brings an additional revenue of

Table 2. *Effect of HPT on black pepper productivity (Yield kg|vine)*

Year	Peruvannamuzhi			Puthuppady		
	Farmer's practices	HPT	Increase (%)	Farmer's practices	HPT	Increase (%)
1986-87	0.356	1.100	209	0.375	1.51	303
1987-88	0.413	1.178	185	0.576	1.895	229
1988-89	0.336	0.836	149	0.415	1.402	238
1989-90	0.498	1.227	146	0.581	1.903	228

In the subsequent years eventhough there was considerable increase in yield compared to control vines (farmer's practice) in both the TTCs, there was a general decline in yield which might be attributed to the erratic monsoon and subsequent drought prevailed during the years. The steady increase noticed is due to the receptivity of the technology by the farmers. Though there is a significant increase in the productivity of the experimental vines, the declining trend in the percentage increase

Rs. 24|- (at the rate of Rs. 35|kg of pepper). This gives net return of Rs. 14|vine. Under the mono-cropping system the average increase in yield is 1.19 kg per vine which gives a net return of Rs. 31.70 per vine.

Implementation of HPT programme in farmer's garden brought out clearly the increase in productivity of black pepper substantiated by the net returns. A total awareness about the benefits of the HPT

Table 3. *Impact of HPT on the build up of soil nutrients (μ g/g)*

	pH		Organic Matter (%)		P		K		Ca		Mg		Fe		Mn		Zn		Cu	
	Expt.	Con.	Expt.	Con.	Expt.	Con.	Expt.	Con.	Expt.	Con.	Expt.	Con.	Expt.	Con.	Expt.	Con.	Expt.	Con.	Expt.	Con.
Range	5.0 to 6.8	4.8 to 6.2	1.3 to 4.8	0.4 to 4.1	9 to 155	2 to 77	63 to 253	43 to 210	299 to 3119	216 to 986	23 to 116	19 to 92	10 to 26	9 to 21	2 to 11	1 to 7	0.7 to 5	0.6 to 2.4	1.2 to 9	1.0 to 4
Mean	5.5	5.3	2.7	1.8	32	17	154	108	691	454	62	42	19	16	6	4	1.5	0.9	4	2

programme could be achieved in the farm holdings of the entire experimental area. In addition an additional 15% employment was generated due to the adoption of the HPT programme.

ANNEXURE 1

CALENDAR OF OPERATIONS AND INPUT REQUIREMENTS FOR ADULT BLACK PEPPER VINES

January-February

Harvesting pepper
Mulching pepper basins @ 5 kg|vine

March-April

Adopting phytosanitary measures i.e., Uprooting of diseased vines alongwith the root system and burning. Avoid replanting during same year.

Taking pits of 0.5 m cube and filling with top soil and organics for replanting

May-July

Drenching of planting pits with 0.2% copper oxychloride @ 5 litres and replanting with healthy rooted pepper cuttings @ 2|standard.

Application of organics

Farm yard manure @ 5 kg|vine
Bone meal @ 500 g|vine
Neem cake @ 1 kg|vine

Application of inorganics

Urea - 110 g|vine
Rock phosphate 200 g|vine
Muriate of potash 120 g|vine

Plant protection

Spraying the foliage with Bordeaux mixture (1%), application of Bordeaux paste (10%) at collar region and drenching the basins with 0.2% copper oxychloride to control *Phytophthora* foot and root rot.

Table 4. *Impact of HPT programme on disease incidence (%)*

Diseases	1985–86 pre-experimental	1986–87	1987–88	1988–89	1989–90
Phytophthora foot rot disease	6.1	2.2	0.5	2.5	2.4
Slow decline	6.4	2.0	1.0	3.2	2.6

Spraying the vine with endosulfan (1.5 ml|litre of water) to control 'pollu' beetle infestation.

Application of phorate @ 30 g|vine and cover with thin layer of soil for controlling nematode infestation.

Cultural operations

Shade regulation
Tying vines

August-September

Application of inorganics

Urea — 110 g|vine
Muriate of potash -- 120 g|vine

Plant protection

Spraying Bordeaux mixture 1% and drenching the basin with copper oxychloride 0.2%

Spraying endosulfan (1.5 ml|litre of water)

Tying vines

Shade regulation

October-December

Application of lime @ 1 kg|vine in alternate years depending on the acidity of soil

Tying vines

Harvesting pepper.