'HIGH PLANT DENSITY' APPROACH TO BOOST BLACK PEPPER PRODUCTION

B. N. REDDY, K. SIVARAMAN AND A. K. SADANANDAN

National Research Centre for Spices, Calicut—673 012, Kerala

Black pepper (*Piper nigrum* L.) popularly known as "King of Spices" is the most important foreign exchange earner among the various spices grown in India. The World demand of pepper by 2000 AD is estimated to be 1,85,000 tonnes. In order to get a lion's share in the global market, India's production has to be stepped up by increasing both area and productivity. Since there is little scope for bringing more new areas under pepper, the alternate is to increase the productivity. The present productivity in India is very low (250 kg/ha) as compared to other countries like Malaysia, Indonesia and Brazil. Among the various agronomic practices, optimum plant density per unit area is of paramount importance in view of achieving stable and high production.

The spacing requirement of black pepper depends on the type of standard, variety and fertility of the soil. High productivity of black pepper in Malaysia and Indonesia is often attributed to the use of non-living standards as support on commercial scale. The highest yield in Sarawak and Brazil could be achieved when higher plant population (2300-2500 plants/ha) was followed with non-living standards. In Brazil investment recovery was the quickest with the spacing of 2 × 1m (5000 plants/ha) although the 2 × 2m (2500 plants/ha) was economically viable on long term basis.

In India, trailing of pepper on non-living standards like reinforced cement concrete (RCC) or granite poles was also proved beneficial as about 125% increase in yield was obtained over living standard. Since about 75% of pepper roots are confined to a soil column of 75 cm to 100 cm in radius and depth it is possible to go for higher plant population per unit area by reducing the spacing. Keeping this in view, high plant density approach through adjustment in plant spacing with 3 varieties viz. Panniyur-1, Karimunda and Aimpiriyan using RCC posts as standards was tried at National Research Centre for Spices, Calicut.

A field experiment was laid out during 1983 at National Research Centre for Spices, Experimental Farm, Peruvannamuzhy. The soil of the experimental plot was of latosol, reddish brown in colour, sandy clay loam in texture, acidic in reaction, medium in nitrogen and low in potash. The treatment consisted of four spacings viz. 3 × 3 (1100 plants/ha), 2.5 × 2.5 (1600 plants/ha), 2.5 × 1.5 (2600 plants/ha) and 2 × 1m (5000 plants/ha). The experimental area was cleared by removing forest growth and later bench terraces were made. RCC posts (3.7 × 0.1 × 0.1 m) were burried in the soil to a depth of 0.7 m for trailing pepper as per spacing treatments. Pepper was planted during first week of June 1983, on the borders of each plot *Albizzia falcataria* was planted to provide over head shade. The pepper vines received uniform dose of 100:40:140 N P_2O_5 K_2O g/vine/year. Prophylactic plant protection measures were taken against diseases and pests. The results of field experiments are discussed here.

YIELD PERFORMANCE

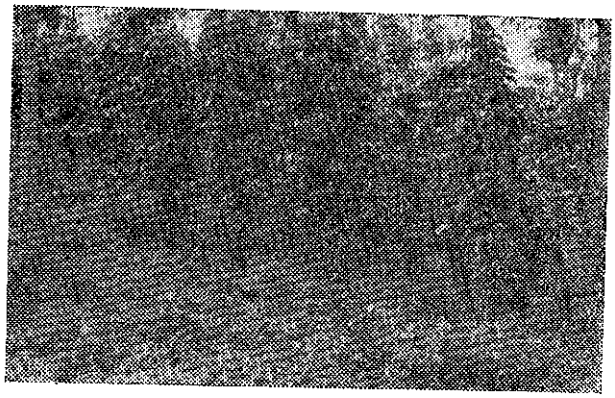
Yield differences were significant among various spacings (Table). The close spacing of 2 × 1m at the rate of 5000 plants/ha (Fig. 1) proved significantly superior to all other spacings in all the years, thus indicated the supremacy of high plant density. The yield performance was almost the same in the spacing of 3 × 3 and 2.5 × 2.5m while 2.5 × 1.5m spacing had an edge over these two spacings with yield increase of 123.8 and 85% respectively. On an average, the closest spacing of 2 × 1m resulted in the yield increase to the tune of 258%, 158% and 60% over the spacings of 3 × 3, 2.5 × 2.5 and 2.5 × 1.5m respectively. Since the non-living standard like RCC posts offers no competition of nutrients and moisture with pepper vine, higher yield is evident. Further high plant density recorded increased yield as individual plant yield was not significantly influenced by various spacings. The mean per vine yield was 1.462, 1.455, 1.469 and 1.199 kg in the spacing of 3 × 3, 2.5 × 2.5, 2.5 × 1.5 and 2 × 1m respectively. The yield performance of pepper varieties (Table) revealed no significant differences over the years although the variety Karimunda proved superior to others. There was 28.7 and 35.4 increase in the yield of Karimunda over Panniyur-1 and Aimpiriyan respectively. The mean yield for the five years (1986-1990) are presented in Fig 2. The highest yield (6160 kg/ha green) was

realised from Karimunda under 2 × 1m spacing followed by Panniyur-1 (4278 kg/ha) at the same spacing.

Table : Yield* (kg/ha) performance of pepper varieties under different spacing

Treatment	Years			
	1988	1989	1990	Pooled
Variety				
Panniyur-1 .	2994	1545	5013	3184
Karimunda .	3971	4088	4231	4097
Aimpiriyan .	2659	2430	3997	3026
C. D. 5% . .	N.S.	874	N.S.	N.S.
Spacing (m)				
3×3 . . .	1448	1225	2349	1674
2.5×2.5 . .	1815	1820	3349	2324
2.5×1.5 . .	3582	3155	4513	3747
2×1 . .	5996	4747	7250	5997
C.D. 5% . .	2585	1366	2002	920

*Green berries N.S. — Not significant.



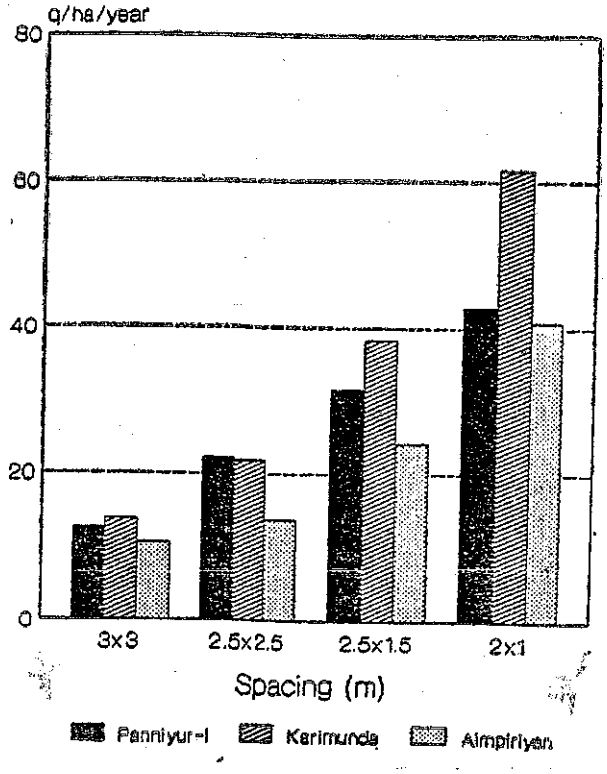
SOIL FERTILITY STATUS

The nutrients analysis of soil samples revealed differential ability of varieties to extract soil nutrients. There was substantial increase in the build up of soil nutrient under wider spacing. As the plant density increased from 1100 to 5000/ha, there was depletion of organic matter, potassium, calcium and magnesium besides micro-nutrients like zinc, iron, copper and manganese. The depletion of potassium was more conspicuous under closer spacing waranting application of potash in such situations.

DISEASE INCIDENCE

The incidence of foot rot caused by *Phytophthora Capsicii* was observed when the pepper vines are four years old. Among the three varieties, Karimunda was more susceptible to foot rot followed by Panniyur-1 and Aimpiriyan. There was no consistent indication of the disease incidence in various spacings. The percent incidence varied from 5-8% in different treatments. Prophylactic plant protection measures such as spraying of Bordeaux mixture (1%) for foliar infection, drenching of copper oxychloride (0.2%) for root infection helped to keep the disease under check in various treatments.

Fig.2 MEAN YIELD OF PEPPER UNDER DIFFERENT SPACING



ECONOMICS

Growing of pepper on non-living standards has to be planned with careful consideration of the various costs involved in the gross investment on the garden. Initial investment for the cost of RCC posts is high in spite of their low depreciation value. The projected economics for raising pepper on non-living standard with 3 × 3m spacing indicated that it becomes economically viable only when the plantation is maintained for 12 years. The benefit cost will be 1.23 with internal rate of returns as 20.61%. The fertilizer schedule and plant protection measures have to be streamlined when the pepper has to be cultivated under high plant density systems. As a long term strategy, raising black pepper on non-living standard at optimum plant density in a phased manner to the extent possible may go a long way in augmenting pepper production thereby increasing export earnings. However, in order to encourage high investment at initial stages, the financial institutions should come forward for rescue of the planters so that the high plant density approach becomes sustainable for increasing the black pepper production.