Production System and Technology Adoption Profile of Black Pepper Cultivation in Kerala

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Abstract

Within India, Kerala is the spice garden. However, the pepper cultivation system in Kerala is now handicapped by a number of problems. The yield of this crop has declined mainly due to senile plantations and minimum input use, on account of declining market price and declining profit margin. The present study was undertaken covering three districts of Kerala through a sample survey to study the features of the production system and track major shifts, study the technology adoption profile of the farmers and identify major constraints as perceived by the farmers. Around 38 per cent of the farmers adopted organic production system and technology adoption profile showed a less input intensive approach. Even though 60 per cent of farmers practiced rain fed cultivation, 15 per cent fully irrigated and 25 per cent adopted irrigation partially. Majority of the farmers were holding land between 80 cents to 4.5 acres. Around 40 per cent of the total vine population was in the pre-bearing stage. There is slow and gradual increase in adoption rate of improved varieties and majority of the farmers sourced new planting material from own fields, showing less dependence on public and private nurseries. The major field problems reported by the farmers are pre-bearing loss of the vines, and many biotic problems like pest and disease incidence and environmental problems like shifts in climate especially rainfall.

Keywords: Black pepper production system, adoption, constraints

Introduction

Pepper, known as the King of Spices, is one of the oldest and most widely used spice in the world. Historically black pepper like other plantation crops *viz.*, coffee, tea, rubber and cardamom, was being considered as a foreign exchange earner to overcome its acute shortage (Nayyar & Sen 1994). With socio-economic development, the household consumption of spices like black peeper, turmeric, ginger *etc.* is steadily increasing in all regions of the country. (Srivastava *et.al.* 2013, Yogesh *et. al.* 2013). Black pepper is mainly cultivated in the states of Kerala,

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Karnataka and Tamil Nadu. Its origin has been traced in the hills of South Western Ghats of India. It is now grown in Indonesia, Malaysia, Sri Lanka, Thailand, China, Vietnam, Cambodia, Brazil, Mexico and Guatemala apart from the country of origin. Most of these countries are new entrants in the production scenario.

In India, pepper is commonly cultivated as a "homestead crop" by small and marginal farmers or grown as an intercrop in plantations of coffee, tea or areca nut. Cultivation of pepper as a pure crop is also practiced though it is becoming rare. Kerala is the major producer with more than 89 per cent of area and 95 per cent of total production in India followed by Karnataka and Tamil Nadu. It is also cultivated in certain pockets of other states *viz.,* Andhra Pradesh, Pondicherry, West Bengal, Odisha, Maharashtra, Goa, and Andaman & Nicobar Islands and in North Eastern States. Black pepper is one of the important crops which provides a major source of income and employment for rural households in Kerala - where more than 2.5 lakh farm families are involved in pepper cultivation (Madan. *et. al.* 2007).

In the recent past, the pepper sector in India witnessed drastic changes in area, production and exports. India's share of world black pepper trade reduced from 19.05 per cent during 1970-71 to 8.35 per cent in 2012-13 in terms of volume and from 24.1 per cent to 6.36 per cent in terms of value during the same period. In Kerala, the area under pepper is estimated at 84,065 ha and production at 29,408 tons during 2013-14 (Economic Review 2013). The area under pepper cultivation in Kerala was 90,918 hectares during 1957-58 and it increased to 2,37,998 hectares in 2005- 06 and since then declined to 84,707 hectares during 2012-13. The increase in production was marginal in absolute terms and productivity was stagnant and low at 513 kg/ha. In a SWOT analysis, it is reported that low productivity of the crop is the major weakness, high intrinsic quality is the strength and increasing domestic demand for the produce is the opportunity (Spices Board 2009).

In the above explained context, a study was carried out in three districts of Kerala state with the objectives of analyzing the black pepper production system and the technology adoption profile by the farmers. The technologies considered were varietal adoption and sourcing pattern by farmers, irrigation and other scientific management practices including organic manure, fertilizers, plant protection measures like fungicide, biological control and soil amendments like liming.

Methodology

The study was conducted in the state of Kerala. Secondary data about pepper production of the last 3 years was analyzed and triennium ending (TE) average

was calculated. Idukki, Wayanad, Kannur, Kollam, and Kozhikode districts of Kerala contributed almost 80 per cent of the total area under pepper cultivation. Of the above five districts, three having a larger area under the crop were selected for the analysis. Forty respondents (pepper farmers) were selected randomly from each district making it a total sample size of 120. Primary data on specific aspects of black pepper cultivation, varietal profile, varietal sourcing pattern and socio-economic variables were collected from the respondents using a structured interview schedule. The adoption level was measured based on percentage scores for various scientific management practices including irrigation.

Results and Discussion

Pepper Production System

The data on production system, water management, age profile and area under the crop are presented in Table 1. There were significant differences in the general management practices adopted by the farmers for pepper cultivation. The organic mode of production was adopted by more than 30 per cent of the respondents. This gives an indication of less intensive nature of cultivation followed by farmers. Resmi *et.al* (2012) reported poor input use efficiency as one of the major constraints attributing to low productivity of black pepper in Idukki district. The area profile shows the predominance of farmers owning area of 80 cents to 4.2 acres (72%) and very small holdings of less than 80 cents (12%).This is also an indication of the predominance of marginal and small farm size sector.

Major area is rain fed (60%) with only 15 per cent irrigated. It is being reported that black pepper being sensitive to water shortage, protective irrigation in summer can increase yield levels (Krishnamoorthy *et. al* 2011 & 2014). Frequent droughts and fluctuating temperature adversely affect the yield of this crop. Although it is a rain fed crop, the yield can be increased by about 50 per cent through irrigation in summer. Majority of the agricultural systems (60%) were non organic with no irrigation.

More than half (53.95%) of the vines in the field were 4-20 years old, which is the productive period of black pepper. About 41.5 per cent of vines are in the pre-bearing stage which is an indication of replanting taken up by farmers every year. Maintenance of vines older than 20 years is considered unviable in the present context due to more climatic stress and other situational factors like shortage of labour. In a similar study about 35 per cent vines in the sample was reported to be in the age group of 5-15 years (Rajeev *et.al.* 2009) Empirical evidences also

suggest the influence of age of the vines on the productivity of both traditional or improved varieties (Resmi *et.al* 2012)

The availability of disease free planting material and financial assistance on easy terms is essential for realizing increased crop yield and profitability. The analysis of the source of planting material revealed that the majority of the planting material is sourced from own field (Table 2). With the prevalence of traditional varieties in the state, this is one contributing factor towards slow pace of varietal spread in black pepper. The external source of improved varieties released through research still continues to be government institutions. The private sector also supplied only few improved varieties. These findings imply a need for policy support and institutional reforms to bridge the large gap in the supply of improved varieties developed by the research stations.

Table 1. Features of Production System

N=120

Particulars	Category	% measure
Agricultural system	Organic	31.08
	Inorganic	68.92
Water Management	Irrigated	15
	Non irrigated	60
	Partially irrigated	25
Number of pepper vines	Average number of vines per farmer	742
Age of vine in the field	Less than 4 years old	41.51
	4-20 years old	53.95
	More than 20 years	4.54
Total cultivable area	Less than 80 cents	12
	80 cents - 4.2 acres	72
	More than 4.2 acres	16

Table 2. Source of Black Pepper Planting Material

Source	Share (%)
Own field	65.50
Govt Institutions	10.36
Private nurseries	16.10
Other farmers	8.04

The wide gap among sources also indicates demand-supply disparity in black pepper planting material supply.

Adoption of Improved Varieties

The pepper varietal profile from the sample farmers in 2013-14 revealed that there had been gradual improvement in the spread of improved varieties from 2 to 12.3 per cent (Figure 1 and Figure 2). Further efforts need to be made for the fast spread of improved varieties so that farmers can derive the maximum benefit from enhanced production from improved varieties. There was a significant drop in the share of traditional Karimunda variety in the black pepper gardens reflecting a shift in acceptance of other improved varieties among the black pepper farmers. As of now traditional and Karimunda varieties dominate the farms which is also indicative of the wide gap as well as constraints in supplying planting material of improved varieties.

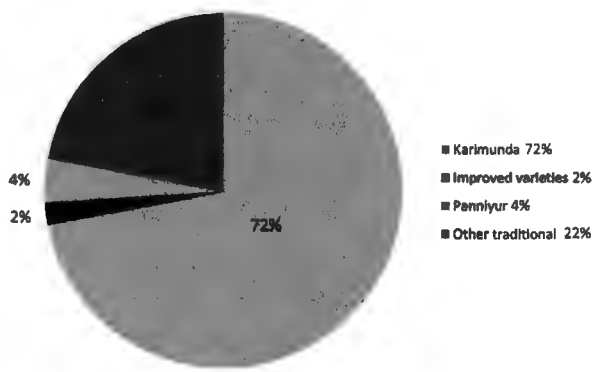

Fig. 1. Varietal Profile of black pepper (Madan and Jose, 2002)

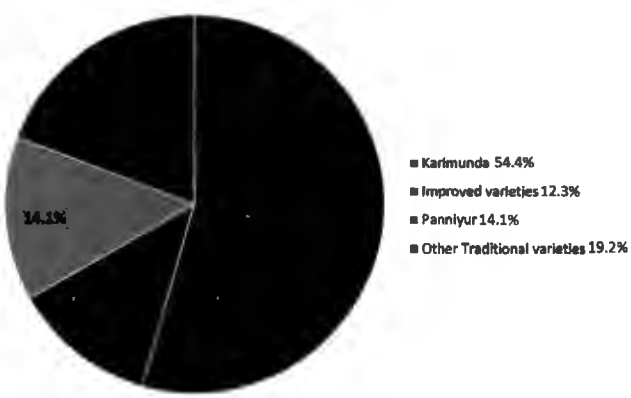

Fig. 2. Varietal composition of black pepper in Kerala 2013-14 (Rejula 2015)

Input Adoption in Pepper Cultivation

The predominant production system in the state follows a homestead farming pattern where several crop components are present in a single plot of land. Generally, the level of input use was very low with more than 40 per cent of the respondents applying no form of fertilizers for black pepper (Table 3). Major share of input use in black pepper is in the form of organic manure and 23.8 per cent of the respondents used NPK Fertilizers. Liming or soil amendments were used by 23 per cent of the respondents and only 15 per cent used fungicides or insecticides. The study infers that low input adoption might be an important reason for low yield and productivity.

Table 3. Input use in Pepper cultivation

Input use	Respondents (%)
NPK Fertilizers	23.8
Organic Fertilizers	36.3
Fungicides/Insecticides	15.1
Trichoderma	6.8
Pseudomonas	5.7
Pochonia	0.03
Liming /Soil amendments	23.0

Perceived Constraints by the Farmers

Constraints in black pepper cultivation were categorized as pre-planting loss/death of vines at pre-bearing stage, biotic constraints and institutional or environmental constraints. Major reason for pre-planting loss as perceived by farmers was climate related problems like heavy rainfall, high humidity and drought conditions in the region. Average pre planting loss estimated was 44 per cent. Though the reasons were categorized separately, the problems related to loss at pre-bearing stage are interrelated and cannot be compartmentalized. However, the information compiled provides a farmers perspective on the problem (Table 4).

Table 4. Reasons for pre-bearing loss

Reasons as perceived by farmers	%	Rank
Climate related problems (Heavy rainfall / high humidity/drought)	47	1
Pest and disease	39	2
Transplanting shock	11	3
Lack of care	3	4

The level of biotic constraints in black pepper production was measured as the number of respondents reporting specific biotic constraints during the last year. Quick wilt/ foot rot were the major biotic constraints in pepper cultivation followed by damage due to slow wilt (Table 5). Majority of the farmers had more than one biotic constraint in the field. Perceived change in climate pattern (42%) was a significant environmental constraint. Respondents perceived labour problem as the second important constraint in pepper cultivation (19%). All these constraints in addition to the market and price pull, explain the gradual decline in area under black pepper in the state. There is an urgent need to adopt area wide strategies for integrated pest and disease management in the crop to arrest the decline in both area and production of black pepper in Kerala. Promoting adoption of scientific inputs and improving input use sufficiency, adequate supply of planting material of improved genotypes developed by research stations, phased replanting and removal of old and senile vines, adoption of protective irrigation in summer to combat climate related stress, are some of the recommendations which emanated out of this study for the development of black pepper sector.

Table 5. Biotic Constraints as perceived by Farmers

Biotic Constraints	Per cent
Foot rot/quick wilt	45.95
Slow wilt	40.54
Pollu beetle	24.32
Leaf blight	12.16
Pollu disease	4.05
Nematode	5.41
Mealy bug	8.11
Wild life	2.70

Conclusion

The study on production systems and technology adoption profile in black pepper was carried out through a sample survey in Kerala. The results indicated a predominance of small and marginal farm sector. The analysis of production system revealed the predominance of organic production system and less intensive input use in the gardens. The proportion of farms under irrigation is meager. There is gradual shift in adoption of improved varieties over time. Majority of the farmers source the planting material from own gardens or other farmer's plots which can be attributed to slow spread of improved varieties as well as insufficient sources for

improved varieties whether public or private institutions. The adoption levels of application of manure, chemical fertilizers and plant protection measures are low to medium. Majority of the farmers reported more than one major biotic constraint in the field. These biotic constraints apart from the market and price pull explain the gradual decline in area under black pepper as reported earlier.

There is an urgent need to adopt area wide strategies for integrated pest and disease management and for combating biotic stress factors in the crop to arrest the decline in both area and production of black pepper in Kerala. Promoting adoption of scientific inputs and improving input use sufficiency, adequate supply of planting material of improved genotypes developed by research stations, phased replanting and removal of old and senile vines, adoption of protective irrigation in summer to combat climate related stress, are some of the recommendations emanating out of this study for the development of black pepper sector.

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