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ICM MODEL OF MAGAHI PAN : AN EFFECTIVE AND VIABLE MODEL FOR ENHANCING LEAF PRODUCTION AND INCOME OF FARMERS IN BIHAR

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ABSTRACT

Integrated Crop Management (ICM) model is an integration of crop production and protection technology assessment on Magahi Pan (*Piper betle* L.). ICM model appreciably performed better than farmer's practices in terms of Agro-physiological, plant protection, extension and economical parameters. ICM model of Mgahi Pan caused marked variation on these parameters and exhibited 15.60 % increase in leaf yield, 28.09 % fresh weight of hundred leaves and gave 16.51 % higher gross return over farmers practices. Also, this model have lower incidence of *phytophthora* foot rot (7.6%). The technology index (56.83 %) showed the feasibility of the ICM technology at the farmer's fields. The extension gap (1600 Dholi/ha) emphasized the need to educate the farmers for adoption of ICM module to overcome the technology gap (15630 Dholi/ha) for enhancing leaf production and income of Magahi Pan cultivation in Bihar.

Key words : *Magahi pan, ICM model, marketable leaf and economics.*

Magahi Pan (*Piper betle* L.) is mainly cultivated by small and marginal farmers in Agro-Climatic Zone IIIB of Bihar specially in Magadh region (Aurangabad, Gaya, Nawada and Nalanda districts) so, it named as Magahi Pan. It play major share in export of betelvine from Bihar due to high palatability nature because of its flavour and taste as reported by Maiti and Saikia (2002). The trade of this crop is estimated about Rs. 100 corers annually in the state (Srivastava and Prasad, 1996). The cultivation practice differs with prevailing climatic condition in different agro-clitnatic zones of Bihar. Betelvine is tropical crop and is raised in open fields in the coastal areas of south India. In other places where temperature goes high in summer and in winter temperature goes very low in such extreme climatic zones of the country, betel vine is raised in artificially made conservatories called Bareja. This practice is common in Bihar.. The cultivation of betelvine in Bihar was confined in the hands of mourners of particular community called Chaurasiya, who are raising this crop from time immemorial. They were poor illiterate and engaged in betel vine cultivation to earn livelihood. In the past no scientific studies were carried out. Hence, the technology for raising this crop could not be improved From planting of betelvines to its marketing various problems are faced by the pan growers but in Bihar, the adverse climatic condition particularly due to low temperature during the winter season limit the crop growth considerably (Yadav and Prasad, 1993) which may be overcome due to adoption of Integrated Crop Management (ICM) model of Magahi Pan developed by Betelvine Reseach Centre, Islampur (Naland) Bihar under ICAR-AICRP Betelvine project.

METHODOLOGY OF ICM MODEL

Integrated Crop Management (ICM) model is an integration of crop production and protection technology assessment in Magahi Pan. Effectiveness and viability of this model was tested by Betelvine Research Centre, Islampur, (B.A.U, Sabour) in 50 farmers field at two location Borisarai and Boridih village in Islampur Block of Nalanda district during the year 2011 under AICRP on MAP & Betelvine project. This ICM model (Table 1) includes combination of integrated nutrient management (Vermicompost @ 10 t ha^{-1} + Azatobactor or Phosphobactor @10 kg ha^{-1} + Mustard oil cake) and integrated disease management practices (Sanitation and soil drenching with 1% Brodeaux mixture at pre-monsoon followed by application of *Trichoderma viridi* @10 kg ha^{-1} after 30 days of planting and again drenching with 1% Brodeaux mixture at 60 days after planting. Beside, vines of Magahi Pan (about 30-45cm long with 3-5 nodes) were treated with *Trichoderma viridi* @ 5g/liter water and used for planting @1.5 Lakh cuttings ha^{-1} during the month of May-June in the concerned year.

The results of farmers practice were compared with the technology of ICM model in terms

Agro-physiological and plant Protection parameters for management of *Phytophthora foot rot* disease. The yield data were collected from both farmer's practice and ICM model. Also, follow working principle of extension parameters for calculating the technology gap; extension gap and the technology index with the help of following formula as reported by (Samui *et al.,* 2000).

Technology gap (Dholi/ha)	=	Potential yield - demonstration yield
Extension gap (Dholi/ha)	=	Demonstration yield - farmer's yield
Technology index (%)	=	[(Potential yield - demonstration yield) X100]/(Potential yield)

RESULTS AND DISCUSSION

Effect of ICM model on Agro-physiological parameters of Magahi Pan : The comparative study of crop performance under ICM model and that of farmers practice from all the farmers field (Table 2a) revealed that ICM model resulted better yield performance (18.07 to 29.42 lakh marketable leaves/ ha) than farmers practices (15.07 to 26.00 lakh marketable leaves/ha) .Thus average yield under ICM practices was 23.74 lakh/ha or 11870 Dholi/ha) than that of farmer's practice ((20.23 lakh/ha or10270 Dholi/ha). The integration of organic nutrients (Vermicompost @ 10 t ha^{-1} + Azatobactor or Phosphobactor @10 kg ha^{-1} + Mustard oil cake) application under ICM model increased the yield of betel leaf as compared with no application of vermicompost and biofertilizer. There was 15.60 % increase in leaf yield than control (farmer's practice). The crop under ICM model produces higher fresh weight of 100 leaves (211 gram) which was ranged from 161.70 to 260.30 g than that of farmer's practices (137.692 to 233.33g). This might be the fact that balanced nutrition under ICM model which is important in promoting growth parameters like plant height, number of leaves/plant and chlorophyll content of leaves, thereby increasing the sink size in terms of leaf size. Thus, vigorous growth in betelvine means production of more leaves (economical part of betelvine), which ultimately determined the size and weight of leaves.. The favorable effect of balanced nutrition under ICM model on betelvine crop were also reported by Dey *et al.* (2003), Sengupta *et al.,* (2004) and Dwevedi *et al*. (2009).

Effect of ICM model on plant Protection parameters of Magahi Pan : It is obvious from the data (Table 2b.) that the relatively more *phytophthora* foot rot incidence (10 %) with ranged from 4.7 to 15.30% was recorded under farmers practices than that of ICM model which have lower incidence of phytophthora foot rot (7.6%) and ranged was from 3.7 to 11.50% .This might be due to the fact that ICM model appreciably reduced the disease incidence as a result of integrated disease management practices (Sanitation & soil drenching with 1% Brodeaux mixture at pre-monsoon followed by application of *Trichoderma viridi* @10 kg ha^{-1} after 30 days of planting and again drenching with 1% Brodeaux mixture at 60 days after planting) followed under new model. The results are in close conformity with the findings of Magdum *et al*. (2009) who emphasized on integrated disease management (sanitation followed by one soil application of 1.0% bordeaux mixture at pre-monsoon and one soil application of *T. horzianum* after one month of bordeaux mixture application as well as one soil application of 1.0% bordeaux mixture at 2 months after its first application) in betelvine crop for reduction of incidence of both leaf rot and foot rot. Similarly, Dasgupta and Maiti, (2008) also reported the disease controlled in belelvine by soil drenching with 1% Bordeaux mixture application.

Effect of ICM model on extension parameters : It is evident from the data (Table 2c.) that the technology gap was 15630 Dholi/ha. The technology gap observed may be attributed to the dissimilarity in the trends adopted by farmers and day by day enhancing diseases incidences as well as changing weather condition. Hence timely application of ICM technology to manage *Phytophthora foot rot* disease incidence in betelvine resulted into minimize the technology gap for yield level of different situations. The extension gap which was 1600 Dholi/ha emphasized the need to educate the farmers through various means for adoption of Integrated Crop Management module for the management of *Phytophthora foot rot* disease in betelvine. The technology index (56.83 %) showed the feasibility of the ICM technology at the farmer's fields.

Effect of ICM model on economics of Magahi Pan : The economics of betelvine crop was varied in various months of the year due to variation of leaf yield and quality in different months (Table 3). It fetched comparatively higher market price during the months of January to March (Rs. 150 - 300/Dholi) than July to December months (Rs. 30 - 100/Dholi). This is because of quality and size of leaf based on their grading according to size and maturity. Similar result was also

Table-1 : ICM model for Magahi pan cultivation.

Technology followed	Farmers Practices	ICM model
Variety	Magahi Pan	Magahi Pan
Seed treatment	Nil	Trichoderma viridi @ 5g/liter water
Plant population	1.25Lakh/ha	1.5 Lakh/ha
Fertilizer	Blanket application of inorganic fertilizer	Vermicompost @ 10t /ha
Bio-fertilizer	Nil	Azatobactor @10 kg/ha or Phosphobactor @10 kg/ha
Integrated disease management	Chemical control	Sanitation & soil drenching with 1% Brodeaux mixture at pre-monsoon & 60 DAP + Trichoderma viridi @10 kg/ha at 30 DAP
Growth promoter	Mustard oil cake (Blanket application)	Mustard oil cake 5 tons/ha in three equal split application

Table-2 : Effect of ICM model on different parameters of Magahi Pan over farmer Practice.

	ICM model	Farmer Practice
2a. Agro-physiological Parameters		
Range of marketable leaves (Lakh/ha)	18.07 - 29.42	15.07 - 26.00
Average marketable leaves (Lakh/ha)	23.74	20.54
Average marketable leaves (*Dholi/ha)	11870	10270
Increase in marketable leaf yield over farmer Practice (%)	15.60	-
Range of fresh weight of 100 leaves (g)	161.70 - 260.30	137.692 - 233.33
Average of fresh weight of 100 leaves (g)	211	180.51
Increase in average of fresh weight of 100 leaves (%) over farmer Practice	28.09	-
2b. Plant Protection parameters		
Range of Phytophthora foot rot Incidence (%)	3.7 - 11.50	4.7 - 15.30%
Average Incidenc of Phytophthora foot rote (%)	7.6	10.0
Reduction in disease incidence over farmer Practice (%)	31.57	-
2c. Extension parameters		
Technology Gap (*Dholi/ha)	15630	-
l276Extension Gap (*Dholi/ha)	1600	-
Technology Index (%)	56.83	-
*Note : One dholi is equal to 200 leaves		

reported by Maiti (1987) and stated that the selling price of betel leaf decreased in rainy season (June to Sept.) as the production was higher during this time. The price of betel leaf increased during the winter and adjacent seasons (Oct. to May). Thus, marketing of betel leaf creates a big problen1 due to its specialized nature of the production potentiality and perishability in its natur. However, ICM model of Mgahi Pan caused marked variation on gross monetary returns (Table 3). It gave the highest gross monetary returns (Rs. 1455110 /ha) which showed over farmers practices and exhibited 16.51 % higher returns over conventional treatment (farmers practices).

CONCLUSIONS

By adopting ICM technology, farmers can increases their marketable leaves of Magahi Pan with lower incidences of *Phytophthora foot rot* diseases and gets higher market price Thus, ICM model of Magahi Pan proved its effectiveness and viablilt for enhancing leaf production and income of farmers in Agro-climatic Zone III B of Bihar.

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Table-3 : Effect of ICM model on economics of Magahi Pan over farmer Practice.

Month	Grading of betel leaf	Yield (Dholi/ha)		Market price (Rs./Dholi)	Gross Monetary Return (Rs.)	
		ICM model	Farmer Practice		ICM model	Farmer Practice
June-July	Garauti paan	591	524	30.00	17730	15720
June-July	Thethi paan	1190	1030	25.00	29750	25750
Aug-Sept	Thari paan	1190	1030	80.00	95200	82400
Oct-Dec	Herua paan	1190	1030	100.00	119000	103000
Jan-Mar	Gaat paan	2621	2238	300.00	786300	671400
Jan-Mar	Barua paan	2022	1732	150.00	303300	259800
Jan-Mar	Chhutauna paan	824	721	30.00	24720	21630
Jan-Mar	Modwar paan	408	370	20.00	8160	7400
April-May	Lakar paan	1007	875	50.00	50350	43750
April-May	Tapra paan	824	721	25.00	20600	18025
Total		11870	10270	-	1455110	1248875
Benefit of ICM model over Farmer practices (Rs/ha)					206235	-
Percentage increase of income					16.51%	-

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