INNOVARE JOURNAL OF AGRICULTURAL SCIENCE

Vol 1, Issue 1 , 2013 ISSN-2321-6832

Research Article

ADOPTION STATUS AND FIELD LEVEL PERFORMANCE OF DIFFERENT PROTECTED STRUCTURES FOR VEGETABLE PRODUCTION UNDER CHANGING SCENARIO

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Received:23 May 2013, Revised and Accepted:24 May 2013

ABSTRACT

Vegetable crops are short duration in nature and sudden changes in climatic parameters at any developmental phase can affect the normal growth, flowering, pollination, fruit development and subsequently decrease the crop yield. Protected structures can play important role to minimize the impact of climatic change effect. Farmers are gradually adopting different protected structures to combat the climatic vagaries and emerging challenges in vegetable production. To understand adoption and utilization pattern of protected structures, an investigation was carried out during 2011-2012 through questionnaire survey in different vegetable belt of the district. The study revealed that habit of adoption of protected structures namely agro-shade net house, poly-tunnel, poly-house and pro-tray have increased during last 5 years. Poly-tunnel was the most used structure utilized for raising vegetable seedling during rainy season. Seedling rising in pro-trays and crop production inside agro-shade net also gaining popularity among the farmers. Although poly-tunnel was the most adopted structure but the performance of poly-house was emerged as best structure in field condition. Additional investment and lack of knowledge for proper utilization were the major factors hindering the large scale adoption of protected structures.

Keywords: Vegetable crop production, Protected structures, Adoption status.

INTRODUCTION

The changing patterns of climatic parameters like rise in atmospheric temperature, changes in precipitation patterns, excess UV radiation and higher incidence of extreme weather events like droughts and floods are emerging major threats for vegetable production in the tropical zone (Battisti and Naylor, 2009; Tirado *et al*., 2010). Vegetable crops are very sensitive to climatic vagaries and sudden rise in temperature as well as irregular precipitation at any phase of crop growth can affect the normal growth, flowering, pollination, fruit development and subsequently decreased the crop yield. Apart from that high input cost and higher labour wages make vegetable cultivation less profitable under open field condition. Again, in the present scenario, more people are demanding early season/off-season vegetables and high value vegetables at higher price which are not possible to grow under open field situation (Kallo and Singh, 2001). Protected cultivation is a method where plants are getting protected from adverse situation like high and low temperature, abnormal rains, hailstorm, sun burn, insect and disease attack etc (Roychowdhury and Misra, 2001). The main aim of protected cultivation is to create a favourable environment as to nourish the plant for maximum output (Singh, 1998). Protected structures can play important role to minimize the impact of temperature fluctuation, over/under precipitation, fluctuating sun shine hour and infestation of disease and pest (Singh and Satpathy, 2005). Again the control environment can be utilized for growing early season /off-season vegetables and high value vegetables. This may become relevant to those farmers having small land holding who would be benefitted by a technology, which helps them to grow more crops each year and save them from adverse situation. Keeping the fact in mind a study was conducted to collect ground level information about farmers' awareness and adoption trend of protected structures, their perceived benefits. The study also covered the field level performance of different protected structures and the barrier of adoption in large scale.

METHODOLOGY

The study was conducted during 2011-2012 at Coochbehar district of West Bengal. Cooch Behar-II block was purposively selected considering the intensity of vegetable cultivation. 45 vegetable growers were selected randomly for the study. Information was collected through a pre-tested schedule prepared for this purpose. To assign the ranks to the perceived benefits of protected structures and constraints Rank Based Quotient (RBQ) was calculated with the following formula:

$$\text{RBQ} = \sum \frac{fi(n+1-i)}{N \times n} \times 100$$

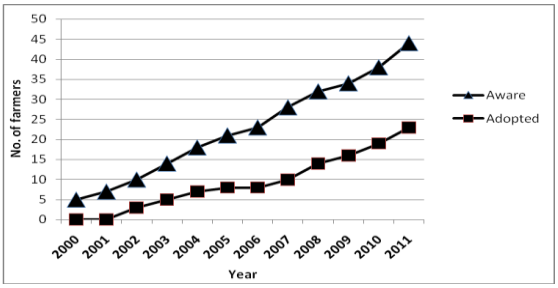
Where, *fi* is the frequency of the informants for i^{th} rank; *N* is the total number of informants and *n* is the number of ranks.

To assess the performance of different structures over traditional practices, farmer's parameters were taken into account and performance score was generated through matrix ranking method. Kruskal–Wallis H-test (a non parametric ANOVA) and Mann-Whitney U-test was applied for comparison of different structures in relation to the traditional practices (control) and within the different protected structures.

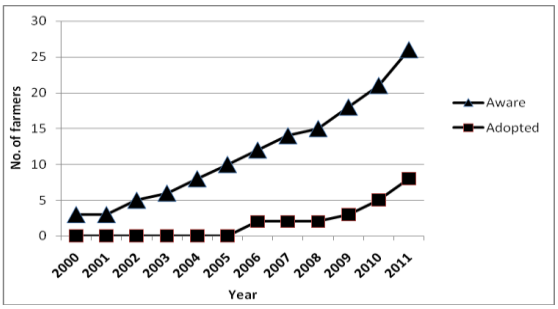
RESULTS AND DISCUSSION

Adoption status of protected structures

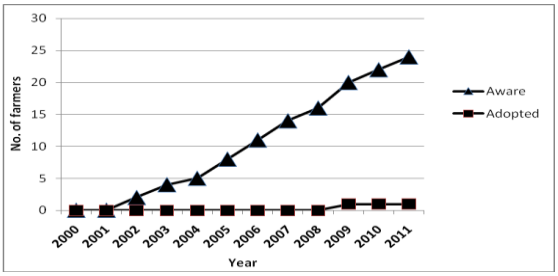
In the study area, poly-tunnel, agro-shade net, poly-house and pro-tray are common protected structures used by the farmers. Among these structures, poly-tunnel is mostly used (23 out of 45) structure utilized for raising seedling of chilli, brinjal, early season cabbage and cauliflower during rainy season. Agro-shade net is used by only 18 per cent (8 out of 45) farmers. It is mainly used for raising high value crops like bell pepper, broccoli, french bean, coriander leaves and palak. To create favourable climate for growing summer season vegetable during winter months the poly house structure is used. In the study area poly-house is adopted by a very negligible percentage of farmers (only 1 out of 45) to cultivate okra, bitter gourd, cucumber and summer squash during winter months for getting higher return. Although pro-tray is a recent introduction in the locality, but due to its diverse use in horticultural sector to raise seedlings of fruits, vegetables, flowers, forestry plants etc the market is expanding very fast.



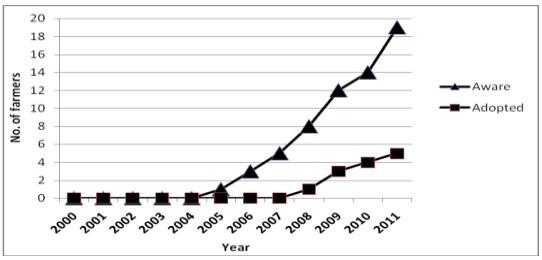
[a] Poly-tunnel



[b] Agro-shadenet



[c]Poly-house



[d] Pro-tray

FIG.-1: AWARENESS AND ADOPTION TREND OF DIFFERENT PLASTIC STRUCTURE OVER LAST 10 YEARS.

Figure-1 (a, b, c & d) represented the awareness and adoption trend of different structures (poly-tunnel, agro-shade net, poly-house, pro-tray) in the study area over last 10 years. The awareness rate showed a steady growth from the beginning of 2000 and onwards in case of poly tunnel, agro shade net and poly-house. Awareness regarding pro-tray though started from 2005 but showed a higher rate of growth than others. Government initiatives in this regard played a vital role to generate awareness and use of such structures.

The habit of adoption of protected structures has increased significantly during last 10 years. Farmers are showing more interest of using poly-tunnel followed by agro-shade net house. The awareness regarding low cost poly-house although started from 2000-01 but adoption rate was almost negligible compared to other structures. This may be due to high initial investment and very short utility period in tropical climatic condition. The adoption rate of pro-tray has got momentum in the recent years may be due to low cost and diverse use in other enterprises like floriculture and forestry seedling productions that also enhanced the availability in the local market.

Perceived benefits and causes of non-adoption of protected structures

Protected structures offered many fold advantages over the open field cultivation (Sanwal *et al*., 2004). However, these structures suffered from some adoption constraints which minimized the rate of adoption in the study area. Table-1 and 2 showed the perceived benefits and causes of non-adoption of different protected structures. Farmers perceived that these structures can manage disease and pest better than the open field condition which encouraged them to rank it first. Other benefits perceived by them were easy crop management under stress situation, possibility of growing off-season vegetables, better quality of produce and higher yield and incomes under stress situation ranked as second, third, forth and fifth benefits respectively.

TABLE 1: PERCEIVED BENEFITS OF PROTECTED STRUCTURE

Perceived benefits	RBQ value	Rank
Higher yield and income under climate stress situation	74.55	IV
Easy crop management under stress situation	80.00	II
Possibility of growing off-season vegetables	78.18	III
Better management of disease and pest compared to open field	90.91	I
Better quality produce	78.18	III

In spite of these benefits a higher number of farmers could not adopt these structures mainly due to additional initial investment as reflected through RBQ value (92.73). No extra premium for better quality produce as perceived by many farmers was another important cause for non adoption of such structures (RBQ=87.27). Lack of knowledge, non availability of materials, lack of technical expertise and lack of demand for off season produce in the local market were some of the important causes which hindered the extensive adoption of these structures in the study area.

TABLE 2: CAUSES OF NON-ADOPTION

Causes of non-adoption	RBQ value	Rank
Additional investment on protected structures.	92.73	I
Lack of knowledge for utilization.	87.27	II
Non availability of plastic materials and technical experts in local market.	78.18	IV
No extra premium for better quality produces.	83.64	III
Lack of demand for off- season produce in the local market.	76.36	V

Farmers level performance of the structures over traditional practices

To evaluate the performance of these structures on a holistic basis the farmers' level evaluation criteria was taken into account. The parameters chosen were running cost per unit production, protection against adverse situation (abiotic and biotic), extra benefit/profit, quality of produce, possibility of off-season production and skill required for production under such structures. Each parameter was assigned a score on 10-point comparative rating scale. Among these parameters, running cost per unit production and skill requirement were scored negatively viz. more the running cost or skill required, less the assigned score. The data were generated through matrix ranking of participatory method. Table-3 summarizes the result of performance appraisal of the structures in comparison to the traditional practices and within the different protected structures. The mean performance depicted that poly-house performed best among all the structures followed by shade-net and poly-tunnel. Mann-Whitney (U) values (6; 5.5; 6; and 4.5) were significant at 5% level. So, all the structures were better in performance compared to traditional practices. Kruskal–Wallis (H)

value (3.81) established that all the plastic structures are *at par* in performance under field situation.

TABLE 3: COMPARATIVE ANALYSIS OF PERFORMANCE OF DIFFERENT PLASTIC STRUCTURES

Quality Parameters	Shade net	Poly tunnel	Pro tray	Poly House	Trad prac
Protection against adverse condition (abiotic)	7.50	6.00	5.25	8.75	1.00
Protection against adverse condition (biotic)	7.00	5.50	7.50	8.25	1.25
Extra benefit/Profit	8.00	6.50	7.50	8.75	5.00
Quality of produce	8.75	7.25	8.50	9.25	5.00
Possibility of off-season production	8.50	7.00	8.50	9.00	0.00
Skill required (-)	2.00	5.50	3.50	1.50	6.00
Running cost/unit production (-)	4.25	2.25	3.50	4.75	1.25
Mean Performance score	6.57	5.71	6.32	7.18	2.79
Mann-Whitney U-value in comparison with Traditional Practices	6*	5.5*	6*	4.5*	--
Kruskal-Wallis Test H-value in respect of all structures	3.81 NS				

*significant at 5%level; NS: non significant

CONCLUSION

The farming communities are gradually realizing that protected structures can minimize the crop production risk/uncertainty due to climate change effect. Again adoption of zero energy protected structures like poly-tunnel; agro-shade net, pro-tray will bring better crop performance and will create new opportunity for off-season crop production. However lack of awareness and ignorance among farmers make them unable to exploit the full benefits of protected structures and the technology remains restricted to few farmers. To equip the farming communities about the protected structures and cultivation practices there is urgent need to create skill development training among the progressive growers and efforts should be made for easy availability of the materials in the local market through incentives and subsidies. More awareness campaign through extension services is required to spread and popularize the technologies among the common farmers.

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