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MARKETING AND ECONOMIC ANALYSIS OF UNIVERSITY BOOM SPRAYER

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The University of Agriculture, Faisalabad initiated a project on developing a boom sprayer with the financial assistance of Ministry of Science & Technology (MoST), Islamabad. The machine was designed, developed, fabricated, and tested at the Farm Machinery and Power Workshop- laboratory, and University farm fields. Field efficacy, marketing, and economic analysis of the newly designed sprayer were made after extensively spraying cotton crop at farmer's fields in Southern Punjab, Pakistan. About 91% farmers recommended the use of university boom sprayer because of its effective spray coverage both from under and above the leaves and insect mortality. About 2-3 number of sprays were reduced as compared with conventional spraying system. Savings in insecticide application by using university boom sprayer was found to be Rs. 1,747/ha (20% saving).
Key words: University boom sprayer; marketing, cotton, mortality

INTRODUCTION

Pakistan is a developing country of south Asia. Total geographical area of Pakistan is 79.61 million hectare, out of which 22.15 million hectare is the cropped area. Agriculture is the mainstay of Pakistan's economy employing 48.4 percent of the total work force. Nearly one-fourth (24 %) of the Gross Domestic Product (GDP) is generated by agriculture. About 67.5 percent of country's population living in rural areas is directly or indirectly linked with agriculture for their livelihood. Cotton was cultivated on an area of 2796 thousand hectare during the year 2002-03. The yield of cotton per hectare was 621 kg. Pakistan has become the fifth largest cotton producing country in the world. Cotton is a major cash crop, source of raw material for textile industry and a source of edible oil for the people of Pakistan. The yield of cotton is very low in Pakistan as compared to many other cotton producing countries of the world due to inefficient control of insect/pests on the crop. Pakistan spent Rs. 5320.49 million for plant protection measures during the year 2001-02, and more than 50 % of the total pesticides consumed by cotton. Production of cotton has been provisionally estimated 10211 thousand bales for the year 2002-2003 (Anonymous, 2001-02).

Pesticides have been used for successful and effective plant protection and to increase yield in different parts of the world since 1867 (Hough and Freeman, 1951). Now it has become essential to spray the growing crops economically and profitably. Recent advances in plant breeding and genetic engineering for improving resistance of crop plants to insect pests and disease will undoubtedly reduce the need to rely on conventional pesticides. Nevertheless, there will still be the need of applying pesticides as a relatively easy and quick method of regulation and checking the pest population. Crop losses remain severe in many areas of the world particularly in the developing countries, where irrigation allows pest to survive throughout the year (Matthews, 1992).

There are many types of sprayers being used in Punjab including imported makes and model. The major utility of the tractor-mounted sprayers is in the Southern Punjab where cotton and orchard farming are the main stay of farmers. The University of Agriculture, Faisalabad initiated a project on developing a boom sprayer with the financial assistance of Ministry of Science & Technology (MoST), Islamabad (Iqbal and Younis, 2001). The University Boom Sprayer (UBS) was designed, developed, fabricated, and tested at the Farm Machinery and Power Workshop- laboratory, and University farm fields (Iqbal et al 2005). During the field studies, 61.75% leave spray coverage resulted in 100% mortality of boll worms (Mahmood et al, 2005)

The comparative performance of the machine required a marketing strategy in order to establish its cost effectiveness and field efficacy. The project was designed to incorporate marketing aspects of the developed sprayer and thus one of the manufactures was signed for this purpose. Punjab Engineering Company (Regd.), Samundari Road, Faisalabad was the sole research collaborators for taking the arrangement. The first phase of machine development was completed in the year 2001-02 and the second phase for marketing of the machining was initiated in the cotton season of first year 2002-03 and complete assessment was made in the second season of the year 2003-04. The purpose of the exercise was to standardize the machine spraying system in order to reduce the farmer's costs and save the environment from unwise use of poisonous insecticides.

MATERIALS AND METHODS

This included the following steps:

1. Fabrication of additional 3- units of UBS

The more units were manufactured and their tests were conducted in the workshop/laboratories of the Department of Farm Machinery & Power and later transferred to the field sites. Various locations in Multan region were earmarked to spray cotton crop with the Boom Sprayer. Procurement of raw material was made and working drawings of the UBS were completed. The manufacturer was assigned to develop the laid-down design.

2. Selection of Farmer Fields

The survey of Multan region was conducted and cotton growers of various farm sizes were contacted in the initial stages. Chak Naurang, Aqil Bangla, Sandhilian Wala, Mian Mumtaz Farms and Mian Rauf farms Khanewal, Chak 19 Khanewal, Pak German Institute of Cooperative Agri. Institute Chak 5- Faiz Multan were exhaustively visited to develop awareness about the newly developed UBS. This selection of farmers was on the basis of their interest in using the machine at their farms. Random selection of 30-farmers was made to initially introduce the sprayer UBS. Later on UBS were transferred to different spraying sites when and where required by the farmers in the crop season.

3. Crop Field Area

Keeping in view the average field capacity of the UBS, 2-hectare farms at each site were selected for spraying the cotton crop. The choice of insecticide selection and seed fertilizer use was kept control. The only variable factor was the machine (UBS) in comparison to other conventional designs of Boom Sprayers being used at the adjacent farms. There were two types of farming systems in the region, one of flat planting other ridge planting and both types of crop farm were included for the purpose of spraying with UBS.

4. Training Components

Initial job of first phase at the farmer's field was the training of farmers/drivers and manufacturers to develop technical awareness about the UBS; later certificates distribution amongst the best performance persons was done. The participants were provided a bag full of literature regarding all type of information about the UBS. In order to develop familiarity with the UBS, three days training were conducted at 9-farmer field sites.

The second phase of training was imparted to the manufactures and tractor dealers in order to motivate them for developing further interest in the prospects of UBS manufacturing and selling respectively. Three days training was conducted at various Tehsils of Multan and all the trainees were provided complete set of literature to make them understand the UBS characteristics in the best possible manner.

5. Field demonstration to stake holders

Large gatherings/exhibitions were organized to provide detected information about the technical aspects of UBS and its application procedures. The demonstration was made to mix gathering of educationalist, manufacturers, dealers, mechanics, spare part shopkeepers, farmers, tractor drivers, and students of diploma classes. The key note address on UBS and various speeches related to spraying in Pakistan were also made at these gathering by renowned scientists of UAF, FMI, AMRI, Punjab Agri. Engineering Department, Tehsil/District Nazims, Executives of manufacturing Industries and dealers, and small and large farms cotton growers. The demonstration was made comprehensively and responses were tabulated. The inauguration ceremony of UBS was done at Mian Mumtaz Farms Khanewal Multan 7-km G.T. Road on June 26, 2004. Also another display ceremony of UBS was done at Pak-German Institute, Chak 5-Faiz Multan on September 21, 2004. Both the main functions of UBS were recorded and telecasted by PTV program, Kissan Times (PTV World).

6. Advertisement/displays/talks/audiovisual dissipation

All types of knowledge dissipation techniques adopted in this project were as following (Kotler and Armstrong, 1996 and Kotler, 1994).

1. Broachers
2. National News papers
3. T. V.
4. Radio
5. Trainee News letter

RESULTS AND DISCUSSION

a. Farmers responses after marketing/exhibition

A population sample of 90-farmers was interviewed from three purposively selected sites in the cotton growing areas following statistical purposive sampling technique. Latter on the sprayers were supplied to the farmers as and when required by them to spray their crops on an average 2-hectares per farmer. The number of sprays ranged from 5-7 according to the pest attack symptoms and for preventive measures. The farmers were inquired for the efficacy of the sprayer in comparison to the previously used locally or imported conventional types. The tabulation of the inquiries was made and the respective statistically analyzed results are tabulated with respect to farmers response.

Table 1. The need of sprayer hiring/owning prospects and maintenance expenses of UBS

Q	Question	Response			
1	Do you feel there is a need of sprayer?	Yes.	91%	No.	9%
2	Do you have sprayer at your farm?	Yes.	40%	No.	60%
3	Spray machine expenses?	R&M	40%	Hiring	60%

Table 2. The need for the type of sprays, minimum number of sprays, and maximum interval time

Q	Question	Response			
1	Which type of sprayer do you need?	Local 96%		Imported	4%
2	How many times you spray cotton crop in a season?	Seven 62%	Nine 29%	Eleven	9%
3	What is spraying interval in days?	Eleven 23%	Fifteen 49%	Eighteen	28%

Table 3. The satisfaction level from the use of sprayer, type of sprayer for crop inquired and the tabulation of response is as under.

Q	Question	Response		
1	Are you satisfied from the use of existing sprayer?	Yes 97%	No	3%
2	Which type of sprayer and what stage of crop growth you are using?	Before flowering At flowering At boll formation	Local 100% Local 100% Local 100%	Imported 0% Imported 0% Imported 0%
3	Do you need any new type of sprayer?	Yes 93%	No	7%

Table 4. Response for the available spraying quality, waste of medicine in spraying and they desired for new quality spraying technique

Q	Question	Response	
1	i. Is present sprayer spraying properly?	Yes 1%	No 99%
2	j. Is present sprayer wasting medicine?	Yes 99%	No 1%
3	I. Which qualities of the new sprayer should be?	Savings in medicine 95% Less no of sprays 94% Low prices 95% Best in quality 95% Spraying in time 90%	

Table 5. The performance of the UBS with respect to its operational facilities, its modification requirement and comparative importance

Q	Question	Response			
1	Have you ever used a boom sprayer like UBS?	Yes	0%	No	100%
2	Is the new UBS better than the others?	Yes	96%	No	4%
3	Have you observed any fault in the UBS?	Yes	44 %	No	56%
4	Do you think any modification be made in UBS?	Yes	89 %	No	11%

Table 6. Quality of spraying in response to other sprayer and prospect of purchase/hire of UBS

Q	Question	Response		
1	Is the UBS spraying medicine properly?	Yes 98%	No 2%	
2	Should this UBS be purchase or not?	Yes 40%	No 60%	
3	What do you observe by using UBS?	Medicine saving Yes 98% No 2%	Insect mortality Yes 96% No 4%	Operation easy Yes 96%, No4%

Table 7. Farmers suggestion for buying requirements along with any change in particular for boom length

Q	Question	Response			
1	Will this UBS be well suited for cotton crop?	Yes	89%	No	11%
2	Do you like to be the first buyer of UBS?	Yes	75%	No	25%
3	Should the boom length be increased or decreased?	Yes	99%	No	1%
4	Should this UBS be made multi-crop sprayer	Yes	99%	No	1%

Table 8. Economic Analysis

Item	Conventional system (Rs ha)	UBS (Rs./ha)	Saving (Rs./ha)
Fuel	450.0	360.0	90.0
Repair & Maintenance	116.7	93.4	22.4
Labor	168.75	135.0	33.75
Insecticides	8,000.0	6,400.0	1,700.0
Total (Rs./ha)	8,735.45	6988.4	1,747.05

Table-1 indicates that 91% farming community was in favor of a boom sprayer at their farms for good cotton crop production whereas only 40% farmers had sprayers on their farms and 60% farmers sprayed their crop by hiring sprayers on rental basis. When there was an attack of disease, the owner of the sprayer cannot spare his sprayer for spraying other farmer's farms rather he preferred spraying his crop first. So this delay would definitely destroy the crop of other farms where there was no any sprayer for spraying the disease attacked crop. Therefore, it is strongly recommended that the farmers should be facilitated to have a sprayer at their farms. Tractor dealers can facilitate through custom hiring services to the small farmers.

Table-2 elaborates that 96% farmers were in favor of local sprayers in their farms instead of imported sprayers. This might be due to the availability of local sprayer parts and their cheap price. Forty nine percent farmers reported that they usually sprayed their crop every 15-days, 23% farmers reported that they sprayed after 11-days, and 28% reported that they sprayed after 18-days during the season. So far as the number of sprays is concerned, 62% farmers spray 7-times, 29% farmers spray 9-times, and only 9% farmers spray 11-times during a crop-growing season. This indicates that there was dire need of a sprayer at every cotton-growing farm to cope up with the alarming situation of disease control and thus increase in crop production.

Table-3 indicates that 100% farmers were using local sprayers before flowering, at flowering, and at boll formation of cotton crop. Moreover, 97% farmers were comfortable from the use of sprayers. About 93% farmers reported that they were in need of any new type of more efficient sprayer indicating the poor performance of existing conventional boom sprayer.

Table-4 indicates that 99% farmers were not satisfied from the spraying ability of the conventional sprayers and also 99% farmers reported that most of the medicine was either volatized or was fallen on the ground from the upper surfaces of leaves and does not hit the actual target insects. The farmers have reported that the new sprayer should be such that the spraying quality is excellent, the number of spays is reduced, and wastage of medicine is minimum.

Table 5 indicates that no any farmer had used a sprayer like UBS. About 96% farmers have reported that UBS performed excellent; however, 44% had reported that there were some technical faults in the new system. Eighty nine percent farmers wanted further modification of the new UBS.

Table-6 elaborates that 98% farmers had reported that UBS sprayed the crop very efficiently and killed the target insects 96%. About 98% farmers had reported that UBS saved 15% medicine. The sprayer was easy to operate and maintain; however it needed to understand its operation before starting crop spraying in the field.

Table-7 indicates that 89% farmers suggested the use of UBS for spraying cotton crop. About 75% farmers reported that they intended to buy UBS in the next growing season. About 99% farmers suggested that the boom length be increased in order to reduce the number of passes of the UBS in the field, hence modify the UBS accordingly. More over the 99% farmers suggested that the system be made multipurpose.

The market was studied for the purchase price prospects of the UBS. It was observed the market was saturated with highly diversified market price structures for various types of sprayers irrespective of the material quality of each unit. The fluctuating prices were more towards demand orientation rather than machine quality orientation. The significant feature of simplicity of design was not at all considered by the manufacturer, and frequent break down along with quality spare parts problems (insufficient supply) were a common identified reason informed by the growers. This scenario makes it more relevant to introduce a standard sprayer with simple design, easily opera table with low initial investment and in particular a common machine for small and medium farmers. UBS posses such characteristics and its price range of Rs. 60,000/- per unit are also acceptable to the farmer as well as the seller.

b. Economic Analysis

1. Total area covered by each UBS during the cotton-growing season was 60-ha (Where 2- hectare per farmer was the sample size and 30-farmers was a population Size and average 6-sprays were carried out during the season at each site by UBS and 7.5 average sprays on adjacent farms by conventional boom sprayer).
   Therefore,
   Total sprays by a UBS (2*30*6) = 360 spray-ha
   Total sprays by a conventional sprayer (2*30*7.5) = 450 spray-ha
   Total number of sprays saved by UBS = 90 spray-ha

2. Total fuel cost of tractor during a season
   (@ 5-litre/hr and fuel price Rs.24/litre and sprayer field capacity = 2-ha/hr)

   by UBS $= \frac{5l}{hr} x \frac{1hr}{2ha} x \frac{360spry.ha}{season} x \frac{Rs.24}{l} = Rs.21,600/-$ per season for 60-ha.

   i.e. Rs. 360/ha per season

   by Conventional $= \frac{5l}{hr} x \frac{1hr}{2ha} x \frac{450spry.ha}{season} x \frac{Rs.24}{l} = Rs.27,000/-$ per season for 60-ha

   i.e. Rs. 450 / ha

   Therefore, Fuel saving = Rs. 450–360 = Rs. 90/ha
3. Total average maintenance cost of a boom sprayer during a season
   (Nozzles, filters, minor repairs etc.) = Rs. 7,000/60ha
   = Rs. 116.7/ha for 7.5 sprays by Conv.
   = Rs. 93.4/ha for 6 sprays by UBS
4. Labor, driver and helper (@Rs. 30+15= 45/hr for 60 ha):

   By conventional $= \frac{Rs.45}{hr} x \frac{1hr}{2ha} x \frac{450spray-ha}{season} = Rs.10,125/season$

   $= Rs.-168.75/ha$

   By UBS $= \frac{Rs.45}{hr} x \frac{1hr}{2ha} x \frac{360spray-ha}{season} = Rs.8,100/season$

   $= Rs.-135/ha$
5. Insecticides: = Rs. 8,000/ha for 7.5 sprays by conventional system.
   = Rs. 6,400/ha for 6 sprays by UBS (20% saving)

Economic analysis has been presented in Table 8. The Table indicates that the savings in insecticide by using UBS were found to be Rs. 1,747/ha (Rs. 707.5/acre.

REFERENCES

Anonymous. 2001-2002. Economic Survey of Pakistan. Government of Pakistan, Finance Division, Economic Advisors Wing, Islamabad.

Hough, W.S. and A.M. Freeman. 1951. Spraying, dusting, and fumigating of plant MacMillan Co. New York.

Iqbal, M. and M. Younis. 2001. Development of an environmentally effective boom sprayer for cotton crop. STED project #23, Ministry of Science & Technology, Islamabad,

Iqbal, M., H.S. Mahmood and M. Younis. 2005. Development of a Drop-pipe type University Boom Sprayer. Journal of Engineering and Applied Sciences, N. W. F. P. University of Engineering and Technology, Peshawar, Pakistan, (ISSN-1023-862), 24(1):67-71.

Kotler, P. and G. Armstrong. 1996. Principles of marketing (6th ed.). Prentice-Hall, International, (UK) Limited, London.

Kotler, P. 1994. Marketing management (8th ed.). Prentice-Hall, International, (UK) Limited, London .

Mahmood, H.S., M. Iqbal, Kh. Altaf Hussain and T. Hameed. 2004. Improved surfacecoverage with environmentally effective university boom sprayer. Pakistan Journal of Agricultural Sciences, Society for the Advancement of Agricultural Sciences, University of Agriculture, Faisalabad, Pakistan. (ISSN 0552-9034), 41(1-2):152-157.

Matthews, G.A. 1992. Pesticide application methods (2nd ed.). Longman scientific and technical, Longman Group U.K. Ltd. Longman house, Burnt Mill, Harlow, Essex CM 20, 2J.E.