Journal of Applied Sciences

ISSN 1812-5654

science alert

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Journal of Applied Sciences 7 (3): 397-401, 2007
ISSN 1812-5654

Adoption of Improved Cotton Production Technologies in Katsina State, Nigeria

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Abstract: The research broadly aims at providing information on the technology adoption behaviour of cotton farmers in Katsina State of Nigeria., The study was conducted in 2001 farming season in the Sudan savanna ecological zone where Samcot 8, 9, 10 and other production packages have been introduced to farmers. The sample consisted of 250 farmers selected from Funtua, Daudawa and Malumfashi, in Katsina State. The results indicated a high rate of awareness in the zone. The main sources of information were extension agents and the use of radio. The rate of adoption of improved practice was 78%. The results showed that most sampled farmers were not aware of the complete set of technologies studied. Among the technologies, farmer's awareness of herbicides was least (15%) while the use of fertilizer recorded (85%). The major reasons for non adoption of improved technologies were inadequate knowledge and non-availability of these technologies.

Key words: Technology adoption, cotton, Nigeria

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is one of the most important cash crops in the Nigerian economy. It is grown by about 0.8 million farmers in a total estimated area of 6000-7000 ha. It ranked second to groundnut as cash crop of the North (Ogungbile and Kyari, 1989).

Cotton has made substantial contribution to government revenue through taxes and export; it provides employment to many farming households, grinners and raw materials for textile industries. In addition, cotton seeds provide edible oil for human consumption while cotton seed cake is used as raw material for livestock feed due to its high protein content.

Under the traditional production practices, unimproved seed varieties are planted and spacings are irregular. Under this system, farmers apply fertilizer, insecticides and usually inter-crop cotton with crops like maize, sorghum and millet. Yields are usually very low ranging from 150-200 kg ha^{-1}. The annual production is about 200,000-300,000 bales of lint, equivalent to about 36,280-54,420 tons of seed (181.4 kg/bale) (Idem, 1999). However, in recent years there has been a sharp decline in the production of cotton, despite increasing domestic demand. This has led to the importation of cotton which represents a serious drain on Nigeria's foreign exchange. Possible causes of decline have been attributed to low producers prices, inefficient marketing system and low level of technology employed in the production resulting in low yield (Ogunlela, 2004).

An important step towards determining the importance of cotton research in a given society is to obtain some idea about the rate of adoption of the crop and its related technologies. This information, in addition to serving as input into future technology impact assessment process, can also provide a useful feedback for strengthening the research-extension-farmers linkage on farmers' attitude to recommended practices.

In order to redress these constraints, the Institute for Agricultural Research (IAR), Samaru which has the mandate for research on cotton improvement, developed a package of technologies to improve and increase cotton production. The main components of the package are improved varieties seed (Samcot 8, 9, 10) time of planting, plant density, fertilizer recommendation, cultural practices and crop protection.

The recommended practices investigated were: improved recommended varieties of seed, that is, Samcot 8, Samcot 9 and Samcot 10. Samcot 8 has maturing period of 120-130 days and potential yield of 1500-2000 kg ha^{-1}, while Samcot 9 and 10 mature at 120 days and have potential yield of 2500-300 kg ha^{-1}.

IAR recommended that planting of these recommended varieties begins as soon as the rain established, preferably mid June. For optimum yield, it is recommended that cotton seed should be dressed with Bronocot at the rate of 1.2 g kg^{-1} of cotton seed or mixture of Bronocot and Apron plus at 2.5+5.0 g for one kg of cotton seed (to control bacteria blight and *Alternaria leaf* spot of cotton. The seed rate is 15-20 kg ha^{-1}, sowing at

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5 seeds per hole, the recommended plant spacing is 90×45 cm with two plants per stand, this gives about 50,000 plant per ha.

These technologies have been tested in on-farm adaptive trials across locations in sudan savanna but very little is known about the level of farmers' awareness and adoption of these packages. Efforts have been made to disseminate these technologies to farmers, through the ADP and mass media. The aim of this study was therefore to assess the extent to which farmers adopted these technologies and identify the major problem limiting the usage of these recommendations.

The specific objectives were to:

- Determine the level of awareness and adoption cotton production technologies
- Identify important channels used in disseminating these improved technologies to cotton farmers and
- Identify factors influencing adoption of these recommended practices.

MATERIALS AND METHODS

The study was carried out in Malumfashi, Daudawa and Funtua villages in Katsina state in the Sudan Savanna specifically, in year 2001. The study areas were purposely selected because of the high concentrations of cotton farmers in these areas, the proximity to IAR, (where cotton packages are being developed) and the efforts of ADP work to push cotton innovations to farmers.

Preliminary field visits were made to identify the villages to be surveyed and to inform the village heads of the date of interview. Pre-tested structured interview schedule was used to elicit information from the respondents on recommended practices.

A simple random sampling technique was used for the choice of respondents within each of the selected zone, One hundred farmers were selected from Funtua and 75 farmers each from Malumfashi and Daudawa The difference in the sample size was due to concentration of cotton farmers in Funtua. In all, a total of 250 farmers made up the sample size for the study.

Types of data collected: The data collected from the farmers include those on their socio-economic characteristics, awareness and adoption of improved technologies for cotton production and constraints to adoption of the technologies.

Cotton requires nitrogen, phosphorous, potassium and boron, Nitrogen should be applied at the rate of 60 kg ha^{-1}, 30 kg of P_2O_5 ha^{-1} and 30 kg ha^{-1} of K_2O ha^{-1}. Boron can be applied where micro nutrient is deficient at the rate of 0.75 kg ha^{-1}.Weed is a major problem of cotton. Thus, 2 to 3 timely hoe-weeding are recommended. In addition to these, the following herbicides are recommended, Gardoprim at 3-4 L ha^{-1}, dalapon plus diuron at 2.0+0.8 kg ha^{-1}, alachlor+diuron at 2.0+0.8 kg ha^{-1}.

The recommended pesticides are Karate, Cymbush, Decis, Perfecthion. This should be applied 3-4 times depending on incidence of insect infestation.

Methods of analysis: Percentages were used in analyzing objective 1. Frequencies and percentages were used to achieve objective 2. Multiple regression analysis was used to realize objective.

The explicit regression model for the socio-economic variables influencing the farmers' adoption of improved practices is expressed as follows

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}.....e)$$

Where:

Y = Adoption (measured as the number of packages adopted)
X_1 = Farmers' age in years
X_2 = Household size (number of wives and children/dependants)
X_3 = Hired labour (amount spent)
X_4 = Education (years of schooling)
X_5 = Membership of association (number)
X_6 = Number of extension visit
X_7 = mount of credit received
X_8 = Income (#)
X_9 = Farm size in hectares
X_{10} = Wealth status (possession of durable goods)
X_{11} = Farmers experience (in years)
X_{12} = Awareness (of cotton technologies)
e is the stochastic regressor or error term.
a = Intercept term (constant)

In order to determine the factors influencing the adoption of improved technologies, the adoption index was regressed against the selected independent variables. The linear, semi log and double log functional forms were tried based on the size of R and significance of the variables, the linear functional form was chosen.

RESULTS AND DISCUSSION

Level of awareness and adoption: Awareness is the first stage of technology adoption (Akanya, 1990; Adeniji, 1996), A farmer has to know about new innovation before

adopting it. From the results of the study, there was high degree of awareness of the improved technological package among the respondents.

Table 1 shows that the level of awareness of use of improved seed, chemical fertilizer, planting date chemical control and plant spacing was high among farmers. However the level of awareness of other technologies like herbicides (15%) and seed dressing (26%) was low. The level of awareness was lower for herbicides and highest (85%) for fertilizer application. The most adopted technology was fertilizer application which was adopted by 77% of the respondents. This was followed by use of improved seed (75%) and chemical spraying (72%). The least adopted technologies were herbicides (10%) seed dressing chemicals (21%) and seed rate (39%).

This is contrary to the study on adoption of improved sorghum production technologies by Banta *et al.* (1986) which showed that seed dressing chemical was the most adopted technologies among farmers in Maiduguri area. The reason adduced by farmers in the study area for low adoption rate of herbicides and seed dressing chemicals is that farmers consider the two operations as extra expenses; cotton requires a lot of money especially for spraying as such most farmers conserve their resources for this.

The low adoption of seed rate agrees with the findings of Mijindadi and Njoku (1986) on adoption of rice technologies.

There is a gap between awareness and adoption of innovation. Ahmed (1984) observed a similar gap between awareness and adoption of hybrid cattle among settled pastoralist Fulanis in Kachia LGA of Kaduna State. Also, Adeniji (1996) observed that the use of recommended farm innovations by farmers was less than the knowledge of the innovations.

Sources of information on improved cotton technologies: The sources of information through which the respondents first heard about the cotton package included other farmers, extension agents, use of radio, television, pamphlets, posters and hand bills.

Table 2 shows the various sources of information to farmers on the improved cotton production practices. It shows that extension agents were the major channel through which 74%, of the respondents received information on improved practices while about 53% identified radio as the main source of information. Other sources identified were village heads/friends/and neighbours indicated by 9% of the respondent, while 4% of the respondents identified research institute as the major source.

Table 1: Respondents level of awareness and adoption of recommended cotton production technologies

Improved technologies	Aware (%)	Not aware (%)	Adopted (%)	Not adopted (%)
Plating date	83	17	70	30
Plant spacing	77	23	67	33
Chemical fertilizer	85	15	77	23
Improved seed	79	21	75	25
Herbicides	15	85	10	90
Seed dressing	26	74	21	79
Seed rate	44	56	39	61
Chemical control	74	26	72	28

Table 2: Sources of information on improved cotton practices

Channel	Frequency	Percentage
Extension agents	186	74
Radio	153	53
Village heads/friends/Neignbours	22	9
Research institute	9	4

*More than sample size due to multiple responses

Table 3: Respondents' reasons for adoption

Reasons for adoption	Frequency	Percentage
To obtain more yield/income	240	96
Try out new techniques	62	25
Convince of the practices	48	19
To imitate others who used the technologies well	45	18
Total	350	140

*More than sample size due to multiple responses

The result suggests that the Training and Visit system of extension is effective in the study area. This could be attributed to the constant visits to the farmers on fixed schedules as being pursued by Katsina State Agricultural development Authority (KTARDA). The result is consistent with earlier report by Voh (1980). Atala (1980) and Chikwendu *et al.* (1996) where extension agents were identified as the major source of information to farmers on recommended practices.

The response to radio, was popular because most farmers have radio or were able to listen to farming programmes (viz., Noma Kankara, Noma Arski,) through their friends or neighbour's radio. Radio is equally one of the fastest means of communicating with generality of farmers. this agrees with the findings of Voh (1981) and Adeniji (1996) who found radio as the second source of information after extension agents. The insignificant impact of the printed media such as newspapers, magazines and posters may be due to low educational level of respondents.

Reasons for adoption: The question related to reason for using improved technologies was asked in order to determine the relevance of the technologies. This is presented in Table 3. Ninety six percent of the respondents adopted the innovations to obtain more yield/income, while 25% adopted in order to try out new techniques. Other responses given by the respondents were: conviction and to imitate others who used the technologies.

Table 4: Respondents reasons for non adoption of technologies for cotton production

	Improved technologies							
Variables	Planting date (N = 74)	Seed dressing (N = 198)	Plant spacing (N = 82)	Fertilizer (N = 57)	Herbicides (N = 224)	Insecticides (N = 71)	Improved seed (N = 63)	Seed rate (N = 52)
Expensive	-	20	-	19	-	20	-	-
Lack of labour	-	-	-	-	-	-	10	-
Not useful	17.0	34	10	-	-	-	10	20
Not readily Available	-	-	-	60	3	31	60	-
Inadequate knowledge	65.0	46	90	21	97	49	10	75
Late information	18.0	-	-	-	-	-	10	5
Total	100.0	100	100	`100	100	100	100	100

*Responses were obtained from farmers who did not adopt the technologies

Table 5: Linear regression function for the relationship between adoption of cotton technologies and farmers' socio-economic characteristics

Independent Variables	Coefficient	Std. Error	t-value	Significant
Age	1.336E-03	0.002	0.562	0.575
Education	-4.493E-03	0.015	-0.295	0.768
Income	-1.109E	0.000	-0.399	0.690
Membership of coop	8.494E.03	0.025	0.334	0.739
Farming experience	-3.057E.03	0.002	-1.335	0.183
Farm size	1.771E.04	0.000	0.469	0.639
House hold size	2.661E.03	0.003	0.974	0.331
Awareness	0.647	0.044	14.549	0.000*
Wealth	5.617E-09	0.000	0.404	0.667
Extension contact	3.954E-02	0.013	3.076	0.002*
Hired labour	0.177	0.081	2.188	0.030*
Credit	-2.305E-02	0.058	-0.396	0.693

*Coefficient statistically significant at 1% level, $R^2 = 0.564$, Adjusted $R^2 = O. 542$ F = 25.544 at 0.01 level of significance

An important observation of the finding is that for all practices, the highest proportion of adopters did so to obtain high yield and subsequently to have their income raised. This agrees with Clark and Akinbode (1968) that financial gain and high yield are the apparent reasons why farmers adopted recommended practices.

Reasons for non adoption: Table 4 indicates the reasons for non adoption of improved cotton production technologies. Most respondents complained of inadequate knowledge of the technologies on seed dressing chemicals, planting date, seed rate, plant spacing, use of herbicides. The major reason given by some of the respondents for non-adoption of improved seed and fertilizer application was that they were not readily available. Similar findings were obtained by Nweke and Chidebelu (1991).

Table 5 shows the result of multiple regression analysis of factors affecting adoption of recommended improved practices (Table 5) shows that the R^2 (coefficient of multiple determination) was. 564 which means that about 56% of the variation in the adoption of recommended practices was explained by the variables included in the model. It suggests that the variables have a moderate effect on adoption of recommended practices for cotton production. The remaining 44% could be attributed to the variables not included in the model.

Extension contacts, hired labour, awareness of innovations were the most important variables in the adoption of improved technologies for cotton production. They have positive coefficient, implying that the level. This indicates that the level of adoption increases correspondingly with increase in household size and intensity of extension contact.

Farming experience was negatively related to adoption. This may be because of those farmers who have over the years gained experience in using particular innovation may find it difficult to switch to a new one no matter the perceived benefits. Similarly educational levels, income, membership of cooperatives were found to be statistically not significant. The non significance of education may not be unconnected with the low level of education in the study area. This agrees with that of Patel and Anthonio (1971) and Chikwendu *et al.* (1996) who did not establish any significant relationship between education and adoption behaviour.

CONCLUSIONS

The study shows that there is an appreciable level of awareness of improved technologies for cotton production. However, the level of adoption was low. While it may be somewhat misleading to make generalized conclusions based on this study the findings suggest that some socio-economic variables are important predictors of improved cotton production technologies. Therefore there is the need for promotion of the packages by extension services and other media to enhance the adoption of these technologies.

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