

ADOPTION OF IMPROVED SORGHUM VARIETIES IN THE  
NORTH -WEST ZONE OF NIGERIA

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## INTRODUCTION

Sorghum (*Sorghum bicolor* [L.] Moench) is a major staple cereal food crop in Nigeria. It is grown in an estimated area of 4.5 million hectares with an annual production output of 6 million tonnes. Most of the sorghum is produced in the northern part of the country which lies between latitude 7.5° and 13°N of the Equator. It occupies about 44 percent of the total land devoted to cereals (Yayock *et al.*, 1987). However, the rainfall pattern in this ecology is quite unpredictable with frequent periods of drought in the Sudano - Sahelian region.

Sorghum is indeed an important crop world - wide being fourth in importance among cereal crops. In the developed countries of Europe and North - America most sorghum produced in large scale farms are used in the poultry and animal feed industries. Large quantities of the crop are also used in producing rough paper, biomass energy, industrial alcohol, chemical intermediates, Glucose and other pharmaceutical bases, (Obilana, 1985).

In Africa or Nigeria in particular, sorghum is the most important cereal which provides the staple diet for people living in the savanna zone. It is used mostly for making indigenous foods, beverages and alcohol and non-alcoholic drinks. Indeed, it is considered the most important cereal consumed in terms of kilogrammes consumed per capita. In addition, sorghum crop provides crop residues for livestock feed supplement and as recently recognized, it is a very valuable industrial crop for the brewing industry.

Government and international development agencies notably ICRISAT and the World Bank have made substantial efforts through research and extension to improve

farmers' productivity in sorghum production. As a result, spectacular achievements have been made in breeding early maturing, disease resistant and high yielding varieties. Among the improved varieties released and disseminated to farmers in the last two to five years are ICSV-111, ICSV-400, NR 71176 and ICSH 89002 (ICRISAT, 1997). Other outstanding varieties developed earlier and are being disseminated include KSV 8 (SAMSORG 14) and SK 5192 (SAMSORG 17).

However, the decision to use or adopt an improved technology by an individual is not instantaneous. It is a socio-psychological phenomenon or process that requires a period of time and involves series of stages which have been identified by empirical research (Ryan and Gross, 1943). These stages include awareness, interest, evaluation, trial and adoption (Rogers, 1983).

Also, many factors influence farmers' adoption decision towards improved technologies. These are categorized as:

- (1) attributes of the improved technologies such as appropriateness to the needs and problems of the target clientele (Rogers, 1983 and Mokonnen, 1991),
- (2) personal characteristics of the potential adopters such as age, education and farm size (Voh, 1979 and Atala, 1984)
- (3) diffusion agency/agent characteristics such as agency/agent effort, competence motivation and resource availability,
- (4) characteristics of the social system such as social structure and social norms, and
- (5) the infrastructure e.g. road network and communication facilities.

However, with the amount of resources invested in the research and extension efforts on sorghum production improvement, the government, external donor agencies and other stakeholders would be interested in the outcome of such investments. A necessary starting point for determining the impact of sorghum research on the rural populace is the measurement of adoption of the improved sorghum technology. It is in this light that this study of the adoption of the improved sorghum varieties was undertaken. The knowledge to be generated by the study would be critically important in improving the relevance of sorghum research and extension programmes to rural and national development.

### **Objectives**

The general objective of the study was to determine farmers' rates of awareness and adoption of improved sorghum varieties and the socio-economic and technical factors that influence the farmers' adoption behaviour in the North - West zone (sorghum zone) of Nigeria with particular reference to ICSV-111, ICSV-400, KSV 8 (SAMSORG 14) and SK 5192 (SAMSORG 17) improved varieties. The specific objectives are:

1. To determine the awareness and adoption rates of improved sorghum varieties.
2. To identify the socio-economic and technical factors that influence adoption or non adoption of the improved sorghum varieties.
3. To recommend ways of enhancing sorghum technology adoption rates among small scale farmers.

## METHODOLOGY

Three states namely Kano, Katsina and Kaduna, representing 50 percent of the states in the North - West zone of Nigeria were covered in the survey on the basis of the fact that they are among the largest sorghum producers in the zone and in the country. Five Agricultural Development Project (ADP) zones in these three states were selected, two each in Kano and Katsina states and zone I in Kaduna state. This was done in order to cover most of the ecological zones in the selected states. In each zone, two villages were chosen from which a total of 156 household heads were randomly selected as respondents (Table 1).

**Table 1: Sample Size and Distribution**

State	ADP Zone	Village	Number of Respondents
Kano	I	Gwarmai	15
	I	Gargai	15
	II	Badume	15
	II	Yarrutu	15
Katsina	I	Barhim	20
	II	Gora	20
Kaduna	I	Wanka	24
	I	Maigana	32
TOTAL			156

Data and information were obtained using a structured questionnaire instrument and interviews and trained field enumerators. Adoption was the principal phenomenon of investigation and it was defined mainly in terms of the proportion of total sorghum crop area under improved sorghum variety, i.e.

$$\frac{\text{Area (ha) under improved sorghum variety}}{\text{Total area (ha) under sorghum crop}} \times 100$$

## RESULTS

### Awareness and Adoption of Improved Sorghum Varieties by proportion of Farmers growing them

The rates of awareness and adoption of improved sorghum cultivars in the study area are presented in Table 2.

/ **Table 2: Awareness and Adoption of Improved Sorghum Varieties**

Sorghum Varieties	Percentage of farmers that were Aware of	Percentage of Farmers that Adopted
ICSV 111	39.7	7.7
ICSV 400	58.5	13.5
KSV 8	66.7	32.1
SK 5912	68.6	49.4

The table shows that in the three states covered in the study (Kaduna, Katsina, Kano), the level of awareness of improved sorghum varieties from 39.7% for ICSV 111 to 68.6% for SK 5912. On the average, about 60% of the respondents were aware of the improved sorghum varieties. ]

However, the awareness rates for each of the improved varieties differ from state to state, because of ecological/socio-economic factors. In Katsina state, for instance, there was a high rate of awareness (90%) of ICSV 111 due to the diffusion and dissemination programmes of the Institute for Agricultural Research (IAR) and the West and Central Africa Sorghum Research Network (WCASRN). In Kano state, ICSV 400 was well known to sorghum farmers due to the diffusion efforts of ICRISAT and the Nigeria Brewery Industry. ICSV 400 commands a high market price as it is being used for making lager beer and malt drinks by Guinness Nigeria Limited. In Kaduna state, SK 5912 was very popular with farmers. About 98.2% of the respondents were aware of it.

An important factor to note in the rates of awareness of the improved sorghum varieties is the time the cultivars were released. ICSV 400 and ICSV 111 were released in the mid - 1990s whereas SK 5912 and KSV 8 were released in 1970 and 1982 respectively (IAR, 1989; ICRISAT, 1996). This factor affected the awareness rates of these improved varieties as well as the adoption rates.

Table 2 shows that the adoption rates for the improved sorghum varieties ranged from 7.7% for the newly released ICSV 111 to 49.4% for SK 5912. However, just like the rates of awareness were some important differences in the use of the improved sorghum cultivars in each of the respective states as shown in Tables 3, 4, and 5.

**Table 3: Awareness and Adoption of Improved Sorghum Varieties in Kano State**

Sorghum Varieties	Awareness (%)	Adoption (%)
ICSV 111	40.0	25.0
ICSV 400	56.7	31.0
KSV 8	74.2	45.0
SK 5912	61.5	28.3

**Table 4: Awareness and Adoption of Improved Sorghum Varieties in Katsina State**

Sorghum Varieties	Awareness (%)	Adoption (%)
ICSV 111	90.0	18.3
ICSV 400	67.5	11.7
KSV 8	32.5	30.0
SK 5912	27.5	22.5

**Table 5: Awareness and Adoption of Improved Sorghum Varieties in Kano State**

Sorghum Varieties	Awareness (%)	Adoption (%)
ICSV 111	12.5	1.8
ICSV 400	28.6	7.1
KSV 8	62.5	41.1
SK 5912	98.2	96.4



Although the awareness rate of ICSV 111 in Kano state is 40%, the adoption rate was 25% (Table 2). The farmers indicated that the planting materials were easily obtained from fellow farmers and from ICRISAT station at Kano. The opposite was the case for Katsina state where there was a great awareness (90%) but adoption rate was 18.3% (Table 3). Farmers complained of lack of planting materials (seeds).

The low adoption rate (1.8%) of ICSV 111 in Kaduna state may be explained by the fact that sorghum varieties are specific to ecological zone. ICSV 111 is a short season variety for the dry Sudan ecological zone. This factor also explained the high adoption rate (96.4%) of SK 5912 in Kaduna state. SK 5912 is a late maturing sorghum variety developed specifically for the Northern Guinea Savanna (NGS) in which Kaduna state is located.

#### Adoption Rates by Hectarage Devoted to Improved Sorghum Varieties

Between 1990 to 1998 there seem <sup>to</sup> have been a steady but modest increase in sorghum farm size in the three states covered in the study (Table 6). In 1990 the average sorghum farm size was 2.6 ha and in 1998 it was 3.5 ha. In terms of hectarage put to improved varieties, there was a steady increase from 1990 to 1996 and a decline in the last two years. The decline could be explained by fertilizer scarcity and high cost in the last two years which made farmers tend to go back to traditional varieties that are considered to have less fertilizer requirement.

Adoption rate of improved sorghum varieties in the three states seem to have been steadily declining slightly from 1994 to 1998. This could be a result of a number of factors including expansion of maize, rice and cowpea hectarage especially in the Northern

Guinea Savanna; and the tendency of farmers to revert to traditional sorghum varieties whenever fertilizer and improved seeds are not readily available.

Looking at the individual states (Table 7, 8 and 9) adoption rate is highest in Kaduna state where the oldest of the varieties (SK 5912) was released in 1970. The adoption rate of improved sorghum varieties in the state ranged from 66% to 71%. In Katsina state, the adoption rate ranges from 17% to 27%, while that of Kano state is between 5-8%. The relatively low rates of adoption of improved sorghum varieties in Kano state is probably due to the relatively high average sorghum farm size. Also ICSV 111 and ICSV 400 which are very appropriate for the Sudan Savanna area are relatively new.

In terms of varieties, the adoption rates differ from one variety to another. SK 5912 has the highest adoption rates (or hectareage) followed by KSV 8, ICSV 400 and ICSV 111 (Table 10, 11, and 13).

#### Reasons for Adoption and Non-adoption of Improved Sorghum Varieties

Farmers gave many reasons for adopting improved sorghum varieties. The most mentioned reason was high yield followed by good food quality and early maturity (Table 14). In general, yield seemed to be the most important consideration for adoption or non-adoption of improved sorghum varieties. The next consideration was food quality. In the dry Sudan, an important consideration was early maturity which explained why ICSV 111 and ICSV 400 which are early maturing varieties were rapidly gaining popularity. Drought resistant was also mentioned as a reason for adoption of these varieties in this area. Other reasons for adoption mentioned were good marketability especially for ICSV

400 which is taken as a cash crop; and seed availability (SK 5912 and KSV 8) given to farmers by researchers.

Farmers also gave their reasons for non-adoption of improved sorghum varieties. The major one of which was lack of seed especially for the much sought after ICSV 111 in Katsina state (Table 15). Another important reason for non-adoption was that some farmers were not aware of the new sorghum varieties especially ICSV 111 and ICSV 400 in Kaduna state, for example. Other reasons mentioned include low yield, lack of fertilizer, etc.

#### SUMMARY AND CONCLUSION

Generally the rate of awareness of the existence of improved sorghum varieties was quite high but the adoption rate was low relative to the awareness rate and reasonable comparative to many other agricultural technologies.

However, the general trend in the adoption of improved sorghum varieties seem to be slightly on the decline since 1996. The major constraints to adoption were inadequate supply of improved seeds and scarcity or high cost of fertilizer. There has also been a shift of emphasis from sorghum to other crops such as maize (in the Northern Guinea Savanna or Kaduna state), rice, and cowpea.

SK 5912 (SAMSORG 17) had the highest rate of adoption followed by KSV 8 (SAMSORG 14). However, the rates of adoption of ICSV 111 and ICSV 400 were relatively low but quite encouraging in the Sudan Savanna (Kano and Katsina states) considering the fact that these are quite recent (1994) releases.

In general, there is need for providing adequate improved seeds to farmers and more effective extension contact with farmers through promotional activities. Also, given the long existence and high rates of awareness and adoption of SK 5912 and KSV 8, it is recommended that they be candidates for impact studies and ICSV 111 and ICSV 400 should be subjected to monitoring and evaluation studies.

### REFERENCES

- IAR (1989). Code and Descriptor List of Crop Varieties. Zaria, IAR.
- ICRISAT (1997). ICRISAT Report 1996. Patancheru, Andhra Pradesh India: ICRISAT.
- Lambie, W. (1983). Different Adoption of Innovations. In D.J. Blackburn (ed.) Extension Handbook, Guelph: Univ. of Guelph, Canada.
- Mokonnen, H. (1991). The structure of Agricultural Production Factors, Productivity and Technology Adoption in Cote d'Ivoire. Dissertation Abstracts International 52/074.
- Obilana, A.T. (1985). Sorghum for Industrial Use: Approach Towards Crop Improvement in an Economically Changing Nigeria. Paper presented to Food Industrialists at Cadbury Nigeria Limited, Lagos January 30th.
- Tait, J. and Wapompeth, B. (1987). "Introduction: the Management of Pests and Pesticides" In J. Tait and B. Wapometh (eds.), Management of Pests and pesticides: Farmers Perceptions and Practices. Boulder and London: Westview Press: 1-7.
- Voh, J.P. (1979). An Exploratory study of factors Associated with Adoption of Recommended Farm Practices Among Giwa Farmers Samaru Miscellaneous Paper 73, IAR/ABU, Zaria.
- Yayock, J.Y.; Olupomi Ajayi, S.K. Karikari and J.J. Owonubi (1987). Improvement in the Productivity of Food Grains in Drought - Prone Areas of Nigeria. In J.M. Menyonga, T. Bezuneh and A. Youdeowei (eds) Food Grain Production in Semi - Arid Africa. Ouagadougou: SAFGRAD.

**Table 6: Adoption Rates by Hectarage put to Improved Sorghum Varieties in Kano, Katsina and Kaduna States**

Year	Average Sorghum Farm Size	Average Hectarage put to Improved Sorghum Varieties	Adoption Rate (%)
1998	3.47	0.86	24.8
1997	3.55	0.89	25.0
1996	3.28	0.92	28.0
1995	3.12	0.90	28.9
1994	3.13	0.90	28.8
1993	2.92	0.89	30.5
1992	2.84	0.86	30.3
1991	2.75	0.81	29.5
1990	2.65	0.75	28.3

**Table 7: Adoption Rates by Hectarage put to Improved Sorghum Varieties in Kano State**

Year	Average Sorghum Farm Size	Average Hectarage put to Improved Sorghum Varieties	Adoption Rate (%)
1998	4.69	0.21	4.5
1997	4.92	0.26	5.3
1996	4.36	0.30	6.9
1995	4.24	0.32	7.6
1994	4.29	0.30	7.0
1993	3.75	0.27	7.2
1992	3.61	0.27	7.5
1991	3.53	0.25	7.1
1990	3.42	0.23	6.7

**Table 8: Adoption Rates by Hectarage put to Improved Sorghum Varieties in Katsina State**

Year	Average Sorghum Farm Size	Average Hectarage put to Improved Sorghum Varieties	Adoption Rate (%)
1998	2.85	0.49	17.2
1997	2.85	0.49	17.2
1996	2.75	0.73	26.6
1995	2.36	0.63	26.7
1994	2.30	0.61	26.5
1993	2.31	0.61	26.4
1992	2.25	0.58	25.8
1991	2.22	0.58	26.1
1990	2.11	0.55	26.1

**Table 9: Adoption Rates by Hectarage put to Improved Sorghum Varieties in Kaduna State**

Year	Average Sorghum Farm Size	Average Hectarage put to Improved Sorghum Varieties	Adoption Rate (%)
1998	2.60	1.82	70.0
1997	2.60	1.86	71.5
1996	2.49	1.74	69.9
1995	2.46	1.73	70.3
1994	2.47	1.76	71.3
1993	2.45	1.74	71.0
1992	2.43	1.70	70.0
1991	2.30	1.57	68.3
1990	2.21	1.45	65.6



**Table 10: Average Hectarage of Sorghum Farm put to Improved Sorghum Varieties In Kano, Katsina and Kaduna States**

Year	Average Sorghum Farm Hectarage put to Improved Varieties							
	Sorghum Farm Size All States	ICSV 111	ICSV 400	KSV 8	SK 5912	Total sorghum farm (ha)	Total improved sorghum farm (ha)	Adoption Rate (%)
1998	3.47	0.01	0.02	0.16	0.68	540.95	134.32	24.83
1997	3.55	0.01	0.02	0.17	0.70	553.06	139.22	25.17
1996	3.28	0.01	0.01	0.16	0.74	510.95	143.92	28.17
1995	3.12	0.00	0.02	0.16	0.72	486.95	141.12	28.98
1994	3.13	0.00	0.02	0.17	0.71	407.55	140.07	28.79
1993	2.92	0.00	0.00	0.16	0.72	455.00	138.12	30.36
1992	2.84	0.00	0.00	0.16	0.70	442.43	134.16	30.32
1991	2.75	0.00	0.00	0.15	0.67	428.90	126.71	29.54
1990	2.65	0.00	0.00	0.14	0.61	413.30	117.46	28.42

**Table 11: Average Hectarage of Sorghum Farm put to Improved Sorghum Varieties In Kano State**

Year	Hectarage put to Improved Sorghum Varieties 1990-1998				
	Sorghum Farm Size	ICSV 111	ICSV 400	KSV 8	SK 5912
1998	4.69	0.01	0.02	0.09	0.09
1997	4.92	0.01	0.03	0.09	0.13
1996	4.36	0.01	0.03	0.10	0.16
1995	4.24	0.00	0.04	0.12	0.16
1994	4.29	0.01	0.01	0.14	0.14
1993	3.75	0.00	0.00	0.13	0.14
1992	3.61	0.00	0.00	0.13	0.14
1991	3.53	0.00	0.00	0.12	0.13
1990	3.25	0.00	0.00	0.11	0.12

**Table 12: Average Hectarage of Sorghum Farm put to Improved Sorghum Varieties In Katsina State**

Year	Hectarage put to Improved Sorghum Varieties				
	Sorghum Farm Size	ICSV 111	ICSV 400	KSV 8	SK 5912
1998	2.85	0.03	0.02	0.30	0.14
1997	2.85	0.03	0.02	0.30	0.14
1996	2.75	0.02	0.01	0.30	0.39
1995	2.36	0.00	0.01	0.30	0.32
1994	2.30	0.00	0.02	0.30	0.29
1993	2.31	0.00	0.00	0.30	0.31
1992	2.25	0.00	0.00	0.30	0.28
1991	2.22	0.00	0.00	0.27	0.31
1990	2.11	0.00	0.00	0.27	0.28

**Table 13: Average Hectarage of Sorghum Farm put to Improved Sorghum Varieties In Kaduna State**

Year	Hectarage put to Improved Sorghum Varieties				1990-
	Sorghum Farm Size	ICSV 111	ICSV 400	KSV 8	SK 5912
1998	2.60	0.00	0.01	0.12	1.69
1997	2.60	0.00	0.01	0.15	1.70
1996	2.49	0.00	0.01	0.11	1.62
1995	2.46	0.00	0.01	0.11	1.61
1994	2.47	0.00	0.04	0.10	1.62
1993	2.45	0.00	0.00	0.09	1.65
1992	2.43	0.00	0.00	0.09	1.61
1991	2.30	0.00	0.00	0.08	1.49
1990	2.21	0.00	0.00	0.08	1.37

**Table 14: Distribution of Farmers by Reasons for Adoption of Improved Sorghum Varieties**

Reasons for Adoption of Improved Varieties	Number of Respondents	Percentage (%)
Early maturity	24	15.4
High yield	72	46.2
Good food quality	41	26.2
Drought resistance	5	3.2
Others	14	9.0

**Table 15: Distribution of Farmers by Reasons for Non-adoption of Improved Sorghum Varieties**

Reasons for Non-adoption of Improved Varieties	Number of Respondents	Percentage (%)
No seed	32	20.5
Unaware	24	15.4
Low yield	14	9.0
Lack of fertilizer	12	7.7
Others	10	6.4