ADOPTION OF RECOMMENDED ONION PRODUCTION PRACTICES BY FARMERS IN GORONYO LOCAL GOVERNMENT AREA OF SOKOTO STATE, NIGERIA

By

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DECLARATION

I hereby declare that the work in this thesis titled "**Adoption of Recommended Onion Production Practices by Farmers in Goronyo Local Government Area of Sokoto State, Nigeria"** has been written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma at any institution. All borrowed ideas have been acknowledged in the text and a list of references provided.

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CERTIFICATION

This thesis titled **"Adoption of Recommended Onion Production Practices by Farmers in Goronyo Local Government Area of Sokoto State, Nigeria"** by Abdullahi Tambuwal UMAR meets the regulations governing the award of Master of Science in Agricultural Extension and Rural Sociology of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my beloved mother, Hajiya Fatima (Yargoggo), Alhaji Ummaru Maizane Tambuwal whose boundless love and care for children symbolize the true motherhood. May Almighty God reward her abundantly, Ameen.

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ABSTRACT

This study was carried out to determine adoption of recommended onion production practices in Goronyo Local Government Area of Sokoto State, Nigeria. A multistage sampling procedure was used in this study. Random sampling was used in selecting four villages out of eleven villages from the study area. These villages were Shinaka, Kwakwazo, Kojio and Goronyo. The sample size was 120 onion farmers from the sampling frame of those villages. Descriptive statistics, multiple regression and Analysis of Variance (ANOVA) were used to analyse the data. The result showed that, about 35.00% with mean age of 45.69 of the respondents were between ages of 41-50. Also 56.70 percent of the respondents had only Koranic education. About 27.50 percent had 6-10 numbers of people in their household. Majority of the respondents 51.67 percent had been in onion production for above 15years. Also 68.30% of the respondents had contact with extension agents but not frequently (greater than 6 times in 2012). The result also shows that the mean credit received was ₦ 38,708.33, and majority of the respondents obtained yield of 20,0001-50,000kg/ha. The result also showed that the average mean yield of the respondents was 32.175 tonnes/ha. The results of multiple regression revealed that farming experience, age, complexity, household size, were negatively significant at different levels of probabilities while credit and compatibility were positively significant at different probability levels with an R^2 value of 0.75. Result from the Analysis of Variance (ANOVA), shows that there was no significant relationship between adoption of the recommended onion production practices and onion output, and level of living. Therefore, the null hypotheses were accepted and alternative hypotheses were rejected for output and level of living from onion production. For the income null hypothesis was rejected while the alternative hypothesis was accepted. It was discovered that inadequate storage facilities, inadequate capital and high cost of labour were the major constraints faced by onion farmers. It is recommended that adult education and pre-season training should be organized for onion farmers; farmers should form cooperatives groups for, farm inputs, credit, labour and marketing of onion in order to enhance the adoption of recommended onion production practices (ROPPs) and improve onion productivity in the study area. However, it is desirable and therefore suggested that the following areas be probed for further research. Comparative studies should be conducted to find out the difference in yields between the recommended onion production practices and traditional practices in the study area. It is recommended that future study should consider income of the respondents before and after adoption of recommended onion production practices in the study area.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Agriculture is derived from two Latin words “ager” and “cultura”. “Ager” means land, while “cultura” means to till or to cultivate. Therefore, we can define agriculture as the tilling of the land (Kasim, 2001). In Nigeria, agriculture is still the nations’ main economic bedrock employing 70-80% of the total population, mostly on a subsistence level. Despite its pivotal role to the nation’s economy, agriculture contributes only 25-30% of the Gross Domestic Product (GDP). The sector suffered neglect during the oil boom years (late 70’s and early 80’s). However, significant improvements in food production have been recorded between 1986 and 1990 with an average annual growth rate of 3.6% and a rise in the level of domestic self-sufficiency (Adeagbo, 2011). Atala (1988) observed that the role of extension is particularly important primarily because of the low productivity of farmers arising mainly from the use of traditional technologies, as such the introduction of improved inputs and agricultural practices are prerequisite for increase production in particular and agricultural development in general. Mijindadi (1985) reported that the sharp decline in the Gross Domestic Product (GDP) in the 1970’s led to the initiation of a number of Federal and State Government’s strategies for agricultural and rural development.

Onion (*Allium cepa L.*) is believed to have originated in the near east in an area which includes Iran, Afghanistan and West Pakistan. It has been grown in the West African savanna for a very long time for both food and cash (Kassam, 2011).

According to the United Nations Food and Agriculture Organization estimates, there are seven million acres of land in the world producing over 37 million tones of onions each year. Onion is produced in almost 170 countries of the world. Pakistan has been on the list of the leading onion producers of the world. China ranks first in the world with respect to onion production followed by India, USA, Turkey, Pakistan, Iran, Indonesia, Vietnam and Myanmar (Kabir, 2007). Onion (*Allium cepa L*) is a vegetable crop belonging to the family Liliaceae (Alabi and Adebayo, 2008). Onion is essentially an out of season crop, practiced on hydro-agricultural lands. In Nigeria production is concentrated in the north, more especially in the dry tropical zone. In this light, the greater part of onion production in Nigeria is undertaken specifically in Kaduna, Kano, Jigawa, Katsina, Sokoto, Kebbi, Plateau and Bauchi States. (Anyanwu, 2003)

The natural features of these regions, especially the presence of flood prone plain and river basins and above all the development of vast irrigated lands, create conditions that greatly favour the development of this crop. Onions needs drained soil adequately supplied with humus, alluvial types of soil, well-drained fertile loam and most sandy rich in humus. The soil which onion is planted must be capable of retaining moisture during the dry season because there is the need for high organic matter content in the soil (Anyanwu, 2003).

Onion (*Allium cepa L.*) is a vegetable crop grown almost all over the world. It is grown mainly for its bulb, which is used in every home, almost daily. It is rarely used as a sole dish or in large quantities. Its main use lies in flavouring and seasoning of a wide variety of dishes, which is due to its aromatic, volatile oil the allyl prophyl sulphide which gives a cherished flavour to food. As a constituent of a meal both the green

leaves and bulbs can be eaten raw, cooked in soups and salads. Onions has an important role as a medicinal herb in many communities and is claimed to minimize high blood pressure and other heart diseases due to its favourable action on the elasticity of blood vessels. Onions are good sources of carbohydrates, vitamin A, B and C (Anyanwu, 2003). It is grown and consumed in green state and as mature bulbs (Thompson and Kelly, 1987). The average calculated annual onion consumption was as approximately 6.20kg per person across the world (FAO, 2006).

As an item of world trade, onion rank second in importance after tomatoes among vegetables (Sani and Jaliya, 2010). Onion (*Allium cepa L.*) is an important vegetable crop grown by farmers in northern Nigeria. This was attested to by Ayodele (1996) who reported that in Nigeria, commercial onion production is mainly in the north. Sokoto and Kebbi States are important onion producing states where many farmers grow onion in the fadama under irrigation during the dry season. Onion is one of the major cash crops that have been grown in Sokoto State, particularly Goronyo local government where about 75% of the farmers engaged in onion production. Onion production is therefore, a major source of income to farmers in the area.

1.2 Problem Statement

Onion (*Allium cepa L.*), is a vegetable crop grown almost all over the world. In 1987, the total world export production amounted to over 2.0 million metric tonnes and worth over 299 million US dollars (46,943,000,000 naira) (NAERLS, 2010).But due to the oil boom era which began in 1973, agriculture including onion production have been neglected. Although onion has been grown in Nigeria for a long time, the yield is still very low compared to other regions of the world. The reason for this is because

improved production practices based on research findings have not been adequately adopted by the farmers (NAERLS, 2010). However, there are a lot of recommended practices or technologies that have been developed by Research Institutes and disseminated to farmers by extension agencies but the level of yield appears to be very low (15ton/ha in the area compared with 45ton/ha potential yield in India (Denton and Ojeifo, 1990) (FAO, 2005) and 20-50 ton/ha for Nigeria (Babaji, 2012).

The low yield obtained by onion farmers is happening despite the availability and introduction of improved practices by the Sokoto Agricultural Development Project. This situation raises the following research questions:

i. What are the socio - economic characteristics of the onion farmers in the study area?
ii. What is the level of awareness of recommended onion production practices in the study area?
iii. What is the level of adoption and rate of adoption of recommended onion production practices?
iv. What is the adoption intensity of recommended onion production practices?
v. What are the factors influencing level of adoption of the recommended onion production practices in the study area?
vi. What are the effects of adoption of recommended onion production practices on output, income from onion production and level of living of the farmers?
vii. What are the constraints to adoption of recommended onion production practices?

1.3 Objectives of the Study

The broad objective of this study was to analyse the adoption of recommended onion production practices by farmers in Goronyo Local Government Area of Sokoto State. The specific objectives were to:

i. describe the socio - economic characteristics of onion producing farmers in the study area;
ii. examine the level of awareness of recommended onion production practices in the study area;
iii. determine the level of adoption and rate of adoption of recommended onion production practices in the study area;
iv. identify the adoption intensity of recommended onion production practices by the farmers in the study area.
v. identify factors influencing level of adoption of recommended onion production practices in the study area;
vi. determine the effects of adoption of recommended onion production practices on output, income from onion production and level of living of the farmers, and
vii. identify the constraints encountered by the farmers in the adoption of recommended onion production practices in the study area.

1.4 Justification of the Study

Onion (*Allium cepa* L.) is an important vegetable crop grown by farmers in northern Nigeria. This was attested to by Ayodele (1996) who reported that in Nigeria, commercial onion production is mainly in the north. Sokoto and Kebbi States are important onion producing States where many farmers grow onion in the fadama under

irrigation during the dry season. Onion production is therefore a major source of income to farmers in the area.

The study intended to look at the factors influencing adoption of recommended onion production practices in Goronyo Local Government Area of Sokoto State. The identification and understanding of these factors certainly provided valuable and significant information for policy formulation. The findings of this study would help policy makers in designing policies that will include interest of onion farmers with respect to how to improve their yield, income and level of living. Furthermore, the research will serve as a basis for further researches by the private and public institutions. The research also was useful for the development of a new thesis, thus increasing the literature in the field of study thereby adding to the existing body of knowledge. Moreover, the study was a useful source of teaching material in the agricultural faculties and other educational institutions. The outcome of the research work would provide information and guidance to Inter-Governmental Organizations (INGOs) agencies, Non-Governmental Organisations (NGOs) and development partners wishing to sponsor intervention programmes that will improve the yield, income and standards of living of farmers engaged in onion production. The findings of this research work will provide the respondents with knowledge of the reasons for low adoption of the recommended practices, as well as the constraints encountered in the adoption of recommended onion production practices and this would help the respondents in adjusting their onion production which will result in improving their productivity income and level of living in the study area.

1.5 Hypotheses of the Study

The following hypotheses were tested:

i. There is no significant relationship between socio economic characteristics of the farmers, institutional variables and attributes of the recommended practices and adoption of recommended onion production practices.

ii. There is no significant relationship between adoption of recommended onion production practices and onion output of the farmers.

iii. There is no significant relationship between adoption of recommended onion production practices and income of the farmers.

iv. There is no significant relationship between adoption of recommended onion production practices and the level of living of the farmers.

CHAPTER TWO

LITERATURE REVIEW

2.1 Socio-economic Characteristics of Onion Vegetables Farmers

Ojo *et al*. (2009) studied the profitability and technical efficiency in irrigated onion production under Middle Rima Valley Irrigation Project in Goronyo Sokoto State. They reported that the variables analysed in this study included sex, marital status, age, education, house hold size, years of farming experience and means of land acquisition. They observed that majority of the respondents (93.3%) were males. 67.8% of the sampled farmers were between the ages of 30 and 50 years. Thus, majority of the sampled farmers were middle aged, which could result in positive effect on production. The modal class of educational level of respondents was non –formal education (48.9%) followed by primary education (44.4%).

The study revealed that 88.6% of the farmers were within the range of 0-10 years farming experience while 13.3% had 11 years and above farming experience. Similarly, Nisar Ali Shah *et al*. (2011) in their paper titled Onion Production Potential and prospects for improvement in the farming systems of Punjab Pakistan, observed that socio -economic attributes of the farming related to their families and are generally considered important in the level of receptivity of innovations and boosting farm productivity (Farooq *et al.*, 2006).

The mean age of the farm operators was about 43 years with an average of 9 years of formal schooling and exhibition 21 years (ranged from 2 to 50 years) of farming experience. The average onion growers were found to be more aged with only 14 years of vegetable growing experience against the overall 21 years of experience of whole

farming. In general the educational level in the study area was comparatively low with that of others developed area of the province. The economy of the area was predominantly agrarian. Thus, agricultural production dominates house hold's income. Income is one of the major indicators / determinants of status of a farmer, which in turn influence the farmer's ability to adopt modern production practices of farming.

Sabo and Dia (2009) observed the level of awareness and effectiveness of vegetable technology information in Adamawa State, Nigeria. They reported that majority of the vegetable farmers interviewed were of the male sex, married and were largely polygamous. This is an indication that dry season vegetable farming in this region was male based. On the contrary Agboola (2004) had noted that rural women in Sothern Nigeria provided up to 70% of labour required for dry season vegetable farming. In the same vein Gochwoski and Ngoomba (1999) and Lumpin and Wienberger (2003) reported the preponderance of women farmers in vegetable production in Sourthern Cameroun and Tanzania. Afolabi (2008) studied fadama farming as an environment friendly and viable enterprise in Ondo State, Nigeria. He found that 84.17% of the respondents were males. The dominance of farming by males may be due the crude implements and strenuous activities involved in farming in the study area. Analysis also showed that 95% of these people were married while 5% were single which can have positive effect on the availability of family labour. It also revealed that 94.17% of these respondents were farmers while 1.67% and 4.17% of them were civil servants and night guards respectively. The result also showed that 63.33% of the respondents operated 0.5 hectares or less as farm land while 25% of them had farm size in the range of between 0.6 and 1.0 hectares.

Olayemi *et al.* (2011) studied the assessment of post-harvest losses of some selected crops in Eight Local Government areas of Rivers State, Nigeria. They found out that farming in all zones is largely practiced by females (77.3%). This corroborates the findings of a study financed by the United Nations Development Programme (UNDP) which revealed that women make up some of agricultural labour force in Nigeria World Bank, (2003). Ironically, women are known to be more involved in agricultural activities than men in sub- Saharan Africa (SSA) countries, Nigeria inclusive. As much as 73% were involved in cash crops, arable and vegetable gardening, while postharvest activities had 16% and agro forestry 15% (Afolabi, 2008). Their involvement in agriculture in Nigeria has attracted greater attention in recent years. Most respondents were married (84.5%), while two – third (32.9%) had no educational experienced of improved storage technologies since educational facilitates farmers' adoption of innovations (Onemolease, 2005). The study reveals that young people (age 30 below) are set with the least percentage (11.11%) indicating that young people venturing into farming is decreasing because of the migration of youths to urban settlements in search of white collar jobs. The result also supported the work of Ekong (2003) which proved that farming in Nigeria is dominated by older farmers especially between ages 41 – 50. Chikezie *et al*. (2012) revealed in her findings of factors constraining rural youth involvement in cassava production that majority of the youths in Onu-Imo local government area of Imo State were at the productive age where their energies could be harnessed and utilized for productive venture in agriculture especially cassava production. From his findings 9.17% of the respondents were less than 20 years, 43.33% and 33.33% were between 21–25 years and 26–30 years, respectively, while only 14.17% of the respondents were more than 30 years of age. He also revealed that 81.67% of the respondents were male, while 18.33% were female. According to

Adewale *et al*. (2005) gender is no barrier to active involvement in cassava production activities. However, Oladeji *et al*. (2003) observed that it is generally believed that males are often more energetic and could readily be available for energy demanding jobs like cassava farming. Respondents' education revealed that 52.50%, 38.33% and 4.17% had primary, secondary and higher education respectively. While only 5% of the respondents had no formal education. In terms of farming experience, his study showed that 66.67% of the respondents had been in cassava farming for less than 10 years, 20.83% and 12.50% had been in cassava farming for between 11 – 25 years and more than 25 years respectively. The farming experience shows that farmers will be able to make sound decisions as regards resources allocation and management of their cassava farms. Furthermore, the size of the farm cultivated is a function of population pressure, family size and financial background of the farmers. One major characteristic of small-scale farmers is fragmented land holdings. Their results show that 63.33% of the respondents farmed on less than one hectare, while 33.33% and 3.34% farmed on between 1 - 2 hectares and more than two hectares, respectively. Yasin *et al*. (2003) found a strong and negative relationship between farming experience and adoption of insecticide spray. Size of holdings had no effect on usage of citrus spray, while in the case of social status; farmers with higher social status used more spray, (Bonabana-Wabbi, 2002).

Furthermore, according to Adesope *et al*. (2012) marital status and farming experience of farmers were negatively correlated (inverse relationship) with adoption of organic farming practices.

2.2 Knowledge Level of Onion Farmers

In a study conducted in Bangalore rural district of Karnataka, it was reported that majority of farm youths trained under Women/Youth Training Extension Project(WYTEP) had correct knowledge about different aspects of plant protection measures like names of major pests (83.33%), name of pesticides (70.00%), concentration of pesticide (50. 00%) (Svenskatesh, 1994). It was also reported by the same author that 70% of the untrained youth had correct knowledge of names of major pests, while 41.70% knew names of pesticides and 11.70% had knowledge of concentration of pesticide.

Prasad and Sundaraswamy (1999) conducted a study in Rangareddy district of Andhra Pradesh on knowledge on dry land agricultural technologies and found observed that of 46.33% of the respondents were in that medium knowledge category, whereas the rest of the respondents were almost equally distributed among low (27. 00%) and high (26.67%) knowledge categories. Also, Chapke (2000) in a study on knowledge and adoption level of farmers about bio control measures in Akola district of Maharashtra reported that 79.51% of the respondents had moderate knowledge. Comparatively, less percentage of respondents had low (16.05%) and high (8.04%) levels of knowledge about bio control practices. The overall main and sub-practice wise distributions of respondents revealed that most of them had full knowledge of bio-control measures.

Desai *et al*. (2000) in a study of adoption of recommended technologies for rain fed cotton NHH-44(hybrid cotton) in Dhule district of Maharashtra found that about 67.00% of the cotton growers had medium level, while 33.00% of them had high level of knowledge. Furthermore, the studies revealed that more than two-third of the cotton

growers possessed some knowledge of recommended preparatory tillage practices, inter culturing, improved varieties/hybrids, selection of proper soil type, quantity of organic manures to be applied. More than 50% of the respondents had medium knowledge about plant protection measures, use of proper dose of chemical fertilizers, and proper methods of sowing. Govindagowda *et al*. (2000) conducted a study in Tumkur district of Karnataka state on knowledge of farmers on dry land groundnut and cultivation found that majority (72%) of the farmers had medium knowledge level about dry land farming practices. Kubde *et al*. (2000) study was conducted in Pune of Maharashtra and revealed that large majority of the potato growers had high knowledge of recommended varieties(100%), time of sowing (95.50%), soil type required for cultivation of potato (79.00%), seed rate (67.50%), name of pests of potato and their control measures (54.00%). In another study by More *et al*. (2000) in a study on impact of training of Krishi Vigyan Kendra on knowledge and adoption of cotton cultivation practices by farmers in Parabhani and Nanded districts of Maharashtra. This study revealed that majority of the respondents (62.14%) had medium level of knowledge followed by high (27.86%) and low (10.00%) levels of knowledge of cotton production practices.

Satyanarayana and Punna (2000) conducted a study in West Godavari district of Andhra Pradesh on knowledge of oil palm growers. The study vividly revealed that about 60.00% of the oil palm growers possessed medium knowledge of the recommended technology. Similarly, Sriram and Palaniswami (2000) in a study on extent of awareness of eco-friendly agricultural practices on cotton and found that 59.16% of the cotton growers had medium level of awareness followed by 25.84%, and low level (15.00%).

This implies that, eco-friendly agricultural production practices was known to majority of the farmers followed by variety selection known by about 100% of the respondents.

Atchuta Raju and Radha Krishnamurthy (2001) conducted a study in Guntur district of Andhra Pradesh on knowledge level of betel vine growers observed that 66.67% of the betel vine growers possessed medium knowledge while 17.50% and 15.83% had low and high knowledge about he recommended technologies, respectively. Nagabhushanam and Nanjaiyan (2001) conducted a study in Karnataka state on knowledge of eco-friendly practices among watershed farmers indicated that majority of the respondents (71.11%) possessed the medium level of knowledge on eco-friendly practices followed by 16.11% of respondents in low level of knowledge. The percentage of respondents having high level of knowledge was found to be still less i.e., 12.78%.

Sophia (2001) in another study conducted in Cuddalore district of Tamil Nadu reported that 66.25% of the farmers had medium knowledge followed by 17.50% who had high knowledge level, and 16.25% haven low knowledge of sustainable cultivation practices of cotton production. On the other hand, 80.00, 12.50 and 7.50% had medium, high and low knowledge levels regarding sustainable cultivation practices in sugarcane, respectively. In the same vein Nithyashree and Jagadish (2001) conducted a study in Raichur district of Karnataka state on the knowledge and adoption of Integrated Pest Management (IPM) practices. Among cotton growers of Raichur district indicated that 58.00% of the respondents had low knowledge level of IPM practices of cotton crop, while 34.00% of them had medium knowledge about the IPM practices.

Gupta *et al*. (2001) in their study on knowledge of farmers on improved cultivation practices of rice in Jammu revealed that 62.00% of the respondents had medium level of knowledge followed by 20.67% and 17.33% had high and low level of knowledge, respectively. Lots of studies have been conducted to determine the level of awareness of agricultural innovations and programmes all over the world (Yahaya and Olayide, 2006; Emma, 2010; Akgul and Macaroglu, 2011 and Ajala *et al.*, 2012). Ajala *et al.* (2012) in their work on assessing the effectiveness of improved cassava production technologies among cassava farmers revealed that 46% of cassava farmers had medium level of awareness of improved technologies, while 33% had high level of awareness. The mean awareness score for the respondents' level of awareness was 8.21 with standard deviation of 4.57. They, therefore, concluded that despite the rigorous efforts of the extension agents towards dissemination of the improved technologies, farmers level of awareness is still at medium level. The achievement of a high level of farmer awareness (of the new technologies) will not necessarily result in a high level of adoption. The farmer will only adopt those innovations which he judges to be useful / beneficial to his particular situations. According to Yahaya and Olayide (2006) despite the ongoing cassava revolution in Nigeria and the high level of awareness of associated technologies, lower levels of cassava technologies use still predominates. The findings of Laary (2012) revealed that some farmers have reasons necessitating numerous chemical applications, majority of them do not know why they keep applying agrochemicals. Ajayi and Akinnifesi (2005) have also reported that farmers understand labels that advise users to protect their eyes, nose, mouth, and other parts of the body while applying chemicals.

2.3 Adoption Level of Recommended Vegetables Production Practices

Meti and Hanchinal (1994) conducted a study on the adoption pattern of recommended

cultivation practices of sunflower crop among the farmers in Raichur district of Karnataka found that 42.00% of farmers were using private agency seeds and recommended varieties, 43.33% had used higher seed rate, while equal percent of (18.00%) of farmers used recommended quantity and less than recommended quantity, majority of farmers (66.66%) apply less than recommended quantity of Farm Yard Manure (FYM) and 66.66% had applied more than recommended chemical concentration. Iqbal *et al*. (1996) reported in their study on adoption of cotton IPM practices of cotton that majority of the small farmers of Dharmapuri and Salem district (Tamil Nadu) had highly adopted the IPM practices like use of Nuclear Polyhedrosis Viruses (NPV) (82.98%), use of locally designed light traps(74.47%), removal and destruction of all stages of pests (68.09%), use of parasites that control boll worms (68.08%) and timely sowing of cotton in a short period of time (51.06%).

Paul and Seetharaman (1996) conducted a study on adoption, reinvention and discontinuance of recommended practices in sugar cane in Coimbatore district of Tamil Nadu. They found that only one-fourth (24.00%) of respondents treated sett with fungicides. Jirli (1996) revealed that nearly 48 per cent of vegetable growers were medium adopters, 30% of the respondents were high adopters and 22% were low adopters of integrated pest management practices. Nirmala Devi and Manoharan (1997) conducted a study on guava cultivars and reported that 39.17% of them had moderate level of overall adoption, closely followed by low (33.33%) and high (27.50%) level of adoption.

Ravishankar and Katteppa (1997) in their study on adoption behaviour of potato growers noticed that 50% of the potato growers fully adopted the practice of improved

seed. The practices which were adopted partially by potato farmers were recommended seed rate (81.66%), Farm Yard Manure (56.66%), use of insecticides (28.33%) and use of fungicides (24.16%).

Subashini *et al*. (1997) conducted a study in South Arcot district of Tamil Nadu State and reported that majority of the tapioca growers (43.33%) were found to be medium adopters followed by low (31.67%) and high (25.00%) adopters. Vasantha and Pochaiah (1998) reported that 69.17 per cent of the farmers adopted higher dosage of pesticides followed by recommended dosage (19.16%) and lesser dosage (11.67%).

Sriram and Palaniswamy (1999) reported that summer ploughing season, hand weeding and synchronized planting were adopted by 50% of the farmers. Majority of the farmers adopted practices like mechanical control of pests (9.17%), crop rotation (69.17%), trap cropping (61.67%), pesticides (61.67%). A less percentage of the respondents adopted seed treatment with bio-fertilizer (27.50%), bio fertilizer application in soil (10.83%), alternate furrow irrigation (37.50%), use of pheromone trap (39.17%), yellow sticky trap (10.83%), bio-control agents (30.83%) and destruction of affected plant parts (25.85%).

Vijay Kumar and Narayanagowda (1999) conducted a study on rose growers and found that majority (57.00%) of the farmers had adoption scores ranging between 16 to 19and 36% of them had scores between 14 to 15, while remaining seven per cent of them had scores ranging from 10 to 13%. The maximum score was 19 indicating that the adoption level was above the average level. Jahagirdar and Sundaraswamy (1999) reported that majority of the cotton growers adopted practices like seed rate (92.22%),

use of certified seed (91.10%) fertilizer application (60.00%), plant protection measures (76.76%) and spacing (52.22%).

Kalaskar *et al*. (1999) in their study conducted in Bhatkali district of Maharashtra reported that majority of respondent adopted the cultural practices like grazing by sheep and goat in cotton field after last picking (85.45%) to check the further liberation of insects, deep ploughing (100%) for exposing soil hibernating states of crop rotation (95.15%) for interruption breeding and multiplication of pest and using pest resistant tolerant variety (92.72%) as per the recommendation. Kubde *et al*. (2000) in their study conducted in Pune district of Maharashtra reported that the potato growers had partially adopted recommended spacing (97%), manures (64.5%), fertilizers (55.5%) and plant protection measures (82.0%) and pesticides (68.5%).

Mercykutty and Karippai (2000) revealed that majority of adopters (59.37%) belongs to the moderately high group. But in the case of high and very high groups the percentages of adopters were 9.37% and 6.26%.

Nayank and Shaikh (2000) their study conduction karjat tehsil of Ahmadnagar district of Maharashtra reported that large majority of Shradha farmers (73.97%) did follow the plant protection measures partially as compared to recommended. Only 26.03% of the adopter could follow the complete measures as per recommendation. Ankulwar *et al*. (2001) conducted a study in Lathur district of Maharashtra state on sunflower farmers and noticed that 61.33% respondents did not adopt the irrigation schedule, while 24.67% respondents adopted irrigation schedule completely and 14.00% of them adopted partially. About 50.67% respondents adopted recommended plant protection

measures partially while 40.00% adopted it fully and 9.33% respondents did not adopt plant protection measures.

David *et al*. (2001) conducted a study in Madhurai district of Tamil Nadu on paddy growers revealed that the recommended quantity of Diammonium Phosphate (DAP) for nursery was adopted by 54.16% of farmers and Recommended Nitrogen Phosphorus and Potassium (NPK) fertilizers as based adopted by the 87.50% of the respondents.

Krishna Kumar and Athimuthu (2001) conducted a study in Tiruchirapalli district of Tamil Nadu state and found that two-thirds of the rice growers (65.00%) belonged medium adopters category followed by low adopters to the extent of 23.00% and the rest 12.00% fell under high level of adopters.

Ranish *et al*. (2001) conducted a study in Hisar and Fatehabad tehsils of Haryana state on adoption of rapeseed mustard production technology found that 62.50% of the farmers had medium level of adoption followed by 20.83% high level and 16.67% had low level of adoption. Jansirani *et al*. (2001) in their study revealed that the inadequate of skill, inadequqte of knowledge, high cost, non-availability of inputs in time, not aware of the advantage were the main reasons expressed by betel vine growers for les adoption of recommended technologies in betel vine cultivation. Nagaraj and Katteppa (2002) in their study on adoption of improved cultivation practices of groundnut by farmers of Tumkur and Chitradurga districts of Karnataka State observed that 38.60% of big farmers belonged to medium adoption category. In contrast to this a similar percentage (37.50%) of small farmers belonged to low level adoption category and more number of farmers (36.90%) belonged to medium level of adoption.

Manjunatha *et al*. (2002) conducted study in Mandya district of Karnataka state on adoption pattern of sustainable water management of practices by sugarcane farmers observed that majority (75.50%) of the sugarcane farmers had irrigated the crop grown in red soils once in 5-8 days as recommended, while 18% and 6.5% of them had .Rajnish Sharma *et al*. (2002) conducted a study on Tribals of Chattisgarh found that the reasons and non-adoption of modern technologies of post-harvest management of rice are lack of knowledge (39.5%), no need as perceived by farmers (65%), poor economic status (82.5%) and they fell that self made bins and local treatments are sufficient and within their knowledge (54.16%) .

Mijindadi and Njoku (1985) in a study to assess the extent to which tomato innovations were adopted in cooperative and individual farms in Ikara area of Kaduna State found significant associations between extension contact, membership of associations, credit availability and input delivery and farmer's awareness and adoption of horticultural innovations. Socio-economic factors such as age, household size, formal education, income, social status, family size, social participation and extension contact were all found to be significantly related to adoption (Voh, 1979; Atala, 1980 and Eneh, 2008). However, other factors like political and environmental could have a strong influence on the potential for meaningful local-level participation. Onu and Madukwe (2002) stated that the most important factors affecting adoption behaviour of farmers are their personal and socio-economic characteristics such as age, education, farming experience, income and social status.

2.4 Constraints to Adoption of Recommended Vegetables Production Practices

Constraints in the production of onion have been mainly attributed to poor soil fertility which results in low yield and the inability of the farmers to store highly perishable crop

for a long period of time (Denton and Ojiefo, 1990). Post harvest losses in onion form a major constraint to the achievement of all year round supply of the crop in Nigeria. According to Amans *et al.* (1989) storage of onion bulbs for 2 – 3 months resulted in losses as high as 60%. Cultural practices have however been reported to improve the shelf life of onion as reported by Kale *et al.* (1991). While Henriksen (1984) in the temperate region records no effect on the storage quality of onion with Nitrogen application. El-tabbakh *et al*. (1979), in Egypt however reported an improvement in the storage quality with N application. Kudi *et al.*(2008) Study on Economic Analysis of Garlic Production in Bebeji Local Government Area of Kano State, Nigeria, reported that, the major problems emphasized by the respondents included high cost of inputs like fertilizer, herbicides, and pesticides, high cost of hiring land for irrigation farming and inadequate capital (20%) to expand farm production and 10% complained of low quality of garlic seeds. Another major area of concern was post harvest problems, the respondents (64%) complained of poor storage facilities and 36% of the respondents complained of poor marketing. Nisar Ali Shah *et al.* (2011) study on onion production potential and prospects for improvement in the farming systems of Punjab Pakistan, reported that there were many factors affecting low yield mainly due to high input prices followed by poor accessibility to quality seed, and water shortages. Vegetable production in Nigeria is characterized by use of crude implements, non availability of inputs (Mofeke *et al*., 2003) illiteracy, expensive and complex technologies. Dry season vegetable production has been ongoing for decades providing employment and income for the increasing population during the pro long dry season. However, production is constrained by inadequate infrastructure, agronomic and socio – economic variables. This manifest has reduced number of practicing vegetable farmers and yield. The benefits of improved technology to agricultural development are realized in terms of

increase farm output, higher income, and improved standard of living (Hart *et al*., 2005). Thakur *et al*. (1994) found that low price paid to the farmers, malpractices, inadequate of mechanical grading, packing and proper storage facilities, inadequate of low cost transportation facilities, inadequate of market information and market news, inadequate of price regulation and control, inadequate of processing units and co-operative society were the major marketing problems faced by vegetable growers. Mishra *et al*. (1995) stated that lack of infrastructural facilities, institutional credit and illiteracy were the main marketing constraints. Kiresur and Ganesh Kumar (1998) revealed that absence of storage facilities was the major problem expressed by 91.23% of onion growers followed by delay in payment of sale proceeds (89.47%), high commission charges (84.21%), inadequate of cheapest transport facilities and inadequate infrastructural facilities and civic amenities at the market both expressed by 70.18% farmers. High charges of Hamali (68.42%), lack of proper grading facilities (61.40%) and faulty weighment system (14.04%) were other problems. Mohaptra (1999) stated that due to unavailability of storage go downs, poor transportation facilities, inadequate of government support price for marketing, the farmers were forced to dispose their produce at the lowest possible price, non-availability of adequate institutional credit facilities at right time, compels them to lend from money lenders and middleman at exorbitant rates of interest which forced to sell at a predetermined price to the traders. Besides social obligations (marriage and other ceremonies) which usually occur after harvest season, were the other reasons for early disposal of the products at a lower price. Shah (1999) concluded that due to poor storage conditions in terms of ventilation, majority of the onion producers were seem to market produce immediately after harvesting, various marketing intermediaries had certainly taken advantage of this situation. This had undoubtedly led to unremunerative prices offer for most of onion

producers. Ravishankar and Katteppa (2000) conducted a study on potato growers in Chikmagalur district of Karnataka State. They reported that 94.16% respondents faced the problem of lack of technical guidance, more pests and more diseases, high cost of fertilizer, high cost of plant protection chemicals and non availability of fertilizers in time, were the problems faced by 90.00%, 83.33%, 85.00%, 81.66% and 68.35% of respondents, respectively. Satendra Kumar *et al*. (2000) carried out a study on constraints causing serious concern to turmeric growers in Udaipur district of Rajasthan. They found that high fluctuations in market prices, 'unavailability of suitable variety', resource poor farmers, inadequate of cold storage and ware-housing facility in the study area coupled with high cost of inputs were the major constraints experienced by the turmeric growers. Thyagarajan and Vasanthakumar (2000) conducted a study on constraints to high yields in rice at farm level in South Arcot district of Tamil Nadu. They revealed that inadequate of reasonable support price was found to be the first important constraint by 36.33% of the respondents followed by high cost of inputs was the second constraint expressed by34.00% of respondents. Waman and Patil (2000) reported that high cost of onion seed and fertilizers was considered as major constraints for onion growers. Lack of knowledge about recommended fertilizer doses, difficulty in identifying the pests and diseases of onion, water shortage in summer, labour problem for weed control, in effective and costly weedicides, had the production constraints of onion growers. Labour problem during harvesting, inadequate of knowledge about improved storage structure, inadequate of knowledge about grading, open auction sale leading to less market price, low price and fluctuation in market price, irregular purchase of onion by National Association for Export Development (NAFED) were the marketing problems faced by growers. Mutkule *et al*. (2001) conducted a study on constraints in adoption of chilli technology in Nanded district of Maharashtra. They

observed that majority of the respondents (93.33%) experienced the constraint insecticides and pesticides were costly followed by fluctuation of prices of chilli (86.00%).

2.5 Importance of Onion Production in the Nigerian Economy

Onion is consumed in different ways by different people and forms an essential part of the traditional daily diet. It is a major spice item and ranks among the top 5 vegetables in Nigeria (NIHORT, 1986). It can be eaten raw in salad, fried, boiled or roasted, and also used in flavouring soups, canned food products and other savoury dishes it is used in every home virtually on daily basis (Hussaini *et al*., 2000).

The bulb is used traditionally as a medical herb for the treatment of measles, pneumonia, cold and catarrh recent studies have confirmed that onion helps in fighting Osteoporosis or bone loss (Biochemist, 2005). Onion production is a viable industry that employs plenty labour and the bulbs are traded in large quantities within and between countries of the world (Currah and Proctor, 1990).

Despite the ranking of onion as the second most important vegetable in Nigeria, the present production levels do not meet the demand of the teeming populace (Ayodele, 1996). Limited changes in the traditional production practices may still be lagging behind the national demand (Denton and Ojeifo, 1990) though the consumption of onion cuts across the country, its major area of production is in the northern part of the country, restricted to Fadama areas, and grown mostly during the dry season under irrigation. Similarly, the production level at present is below the optimum realized for

other countries. For example, while it is 45tha^{-1} in India, it is just 15 t ha^{-1} in Nigeria (FAO, 2005).

2.6 Theoretical Framework of the Study

This study is guided by the social change theory using the adoption and diffusion's perspectives.

2.6.1 The social change theory

Ekong (2003) defined as social change as the modifications in human attitudes and behaviour pattern as a result of education (such as extension activities). Change do occur daily in the social system which affect the behaviour of people, and social change theories believe that for change to take place, societies have to move from traditional ways of doing things to modern ways.

Social change may be planned or unplanned (i.e accident). Planned change entails the direct human intervention in the shaping and direction of change toward some predefined goals. Change may also be total or segmental in its coverage. Total change is that which covers a wide range of activities and may lead to a complete transformation of a people's way of life or their social institutions. Segmented change as the name implies covers only a particular portion and may not call for a total transformation system.

Theories of social change have, in general, been concerned with the explanation of (a) the sources of social change (b) the time span of change and (c) the effect of the change in the changing unit. Social change impinges on the society as well as on the individual. At the individual level, the academic emphasise or concern has been on (a) how the

individual learns of innovations; (b) his motivation to change; (c) how he adjust to change and (d) the societal and personal factors impeding social change. Social change is an ever present phenomenon in any society it is the essence of human existence, development and growth (Robinson, 1982) and Moore (1989) defined social change as the significant alteration of social structure in the society. In the same light Rogers (1982) posited that social change as the process through which significant alteration occurs in structure and function of the society.

This theory will help to provide the framework for the understanding of the social changes that have taken place in the life of onion farmers as a result of introduction of recommended onion production practices by the Sokoto ADPs.

2.6.2 Adoption and diffusion theory

Diffusion of innovations is a theory that seeks to explain how, why and at what rate new ideas and technology spread through cultures. Everest Rogers, a professor of rural sociology popularized the theory in his 1962 book "Diffusion of Innovation". He said diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. The origin of diffusion of innovations theory varied and span multiple discipline. Diffusion is the process by which an innovation spread from the source of its invention to the ultimate users or adopters. Whereas adoption process deals with adoption of a new idea by an individual, diffusion process deals with the spread of new ideas in a social system or the spread of innovations between social systems or societies (Rogers, 1995). Thus, diffusion of innovation occurs within a social system which may embrace many situational fields. The segments of the social system in a study area under reference can influence

individual farmers to display varying degrees of innovativeness from innovators to laggards. Opinion leaders who are generally early adopters enhanced diffusion of innovations, while late majorities and laggards hinder it.

Adoption – diffusion theory was the dominant approach in 1960s (Rogers, 1995). Diffusion theorists accepted the products of agricultural research as wholly desirable. Hence, their work focused almost exclusively on the fate of innovations designed for farm use. They employed a communications' model adopted from engineering in which messages were seen to be transmitted from sender to receiver, later adding the engineering term "feedback" to describe receivers' responses to the massage sent to them. They argued that adoption could best be understood as based on the psycho-social characteristics of adopters and non-adopters. Early adopters were found to be more cosmopolitan, better educated, less risk averse, and more willing to invest in new technologies than late adopters, pejoratively labeled 'laggards'. As Rogers further points out, diffusion is not a single embracing theory. It is several theoretical perspectives that relate to the overall concept of diffusion; it is a metatheory. The work of Ryan and Gross (1943) on rural sociology is cited as the beginning of diffusion research. This used interviews as their main method of data collection. This has been a trend in diffusion research since. He further explains that there are four major theories that deal with diffusion of innovations. These are innovation- decision process theory, individual innovativeness theory, rate of adoption theory, and theory of perceived attributes. This theory will help in the analysis of level of awareness, level and rate of adoption of the recommended practices and factors influencing adoption.

2.6.3 Conceptual model

A model is a construction that shows relations existing among variables. These relationships are depicted schematically or mathematically (Asiaka, 2001). Theoretical model is meant by a broad system of explanation which is founded not so much on prior research findings but largely on untested and unproved assumptions about social realities (Ekong, 2003). A concept is a confirmed idea about a phenomenon, and A model is a general conception of a phenomenon example rural society a phenomenon consists of anything human being live or experience so it is the study of life (Hornby, 2005 and Haralambos and Holborn, 2008).Model have been used in research primary as tools for organizing knowledge gained in experimentation (Adebayo and Okunaye, 2004) A model is a figurative expression of relationships. The basic assumptions in this study are that farmers' socio-economic characteristics, institutional and technological factors will play a significant role in influencing adoption of recommended onion production practices to bring about changes in the livelihood of the farmers as shown in figure 1.

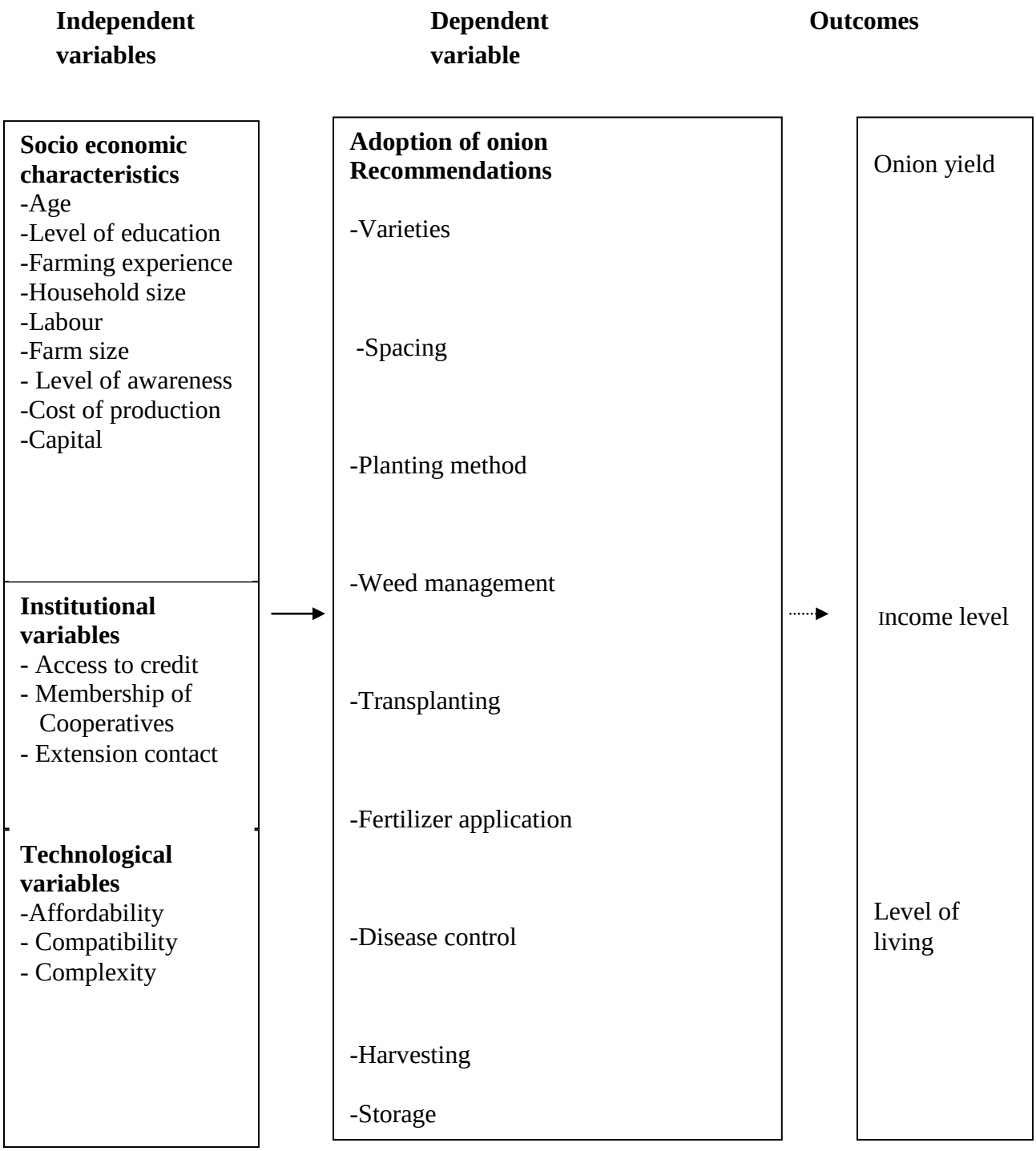


Figure 2.1: A model showing factors influencing level of adoption of recommended onion production practices and the likely outcomes

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

Sokoto State was created in January 1976 with the headquarters in Sokoto. Sokoto State is made up of 23 Local Government Areas, covering a total land area of 26,648,480 square kilometer, Ministry of Agricultural and Natural Resources (MANR, 2002). It shares common border with Niger Republic to the North, Kebbi State to the West and Zamfara State to the East. The state is located within longitudes 4^0 07-6^0-56^1 East and 13^0 50' East and Latitudes $11^0$3-$6^0$55- North (Abdulrahman, 1996). The State had a population of 3,696,999 people based on 2006 population census (NPC, 2006).This population has been projected to 4,544,573 people in 2012 using a growth rate of 3.50% as recommended by Central Bank Annual Report (Umar, 2012).

Sokoto State is surrounded by sandy Savannah and isolated hills. With an annual average temperature of 28.3^0C, Sokoto State experience hotness between March-June. The rainy season is from June to October. From late October to February during the cold season, the climate is dominated by the harmattan, wind blowing savannah dust over the land. The dust dims the sunlight thereby lowering temperature significantly leading to the inconvenience of dust everywhere in houses http://www.sokotostate.com,2008).

The region's lifeline for growing crops is the floodplains of the Sokoto Rima river system, which are covered with rich alluvial soil. The general dryness of the region allows for few crops like millet perhaps being the most abundant, complemented by rice, maize, sorghum and cowpea. Apart from tomatoes few vegetable grow in the

region. The low variety of foodstuffs available has resulted in the relatively dull local cuisine (Wikipedia, 2008).

Goronyo is a Local Government Area in Sokoto State, Nigeria. Its headquarters is in the town of Goronyo, on the Sokoto River. It has an area of 1,704 km^2 and a population of 182,296 at the 2006 census. This population has been projected to 224,089 people in 2012.Goronyo Local Government Area is located between latitudes 13^0 30^1N and Longitudes 5^0 30^1E. The climates consist of a long dry season (October-May) and short wet season (June to September). The mean annual rainfall is 500-750mm (Singh and Graham, 1997) Temperature fluctuates within wide limits from about 15^0C during the cool night to 41^0C during the warm days. The predominant ethnic groups of the area are Hausa and Fulani. Islam is the major religion. About 80% of the people are engaged in various forms of Agriculture. The total land area under onion production in 2012 was 1068.47 ha. The farmers are also known to rear livestock like cattle, sheep and goats.(http;\\www.sokotostate.gov.ng). The total land area under onion production in 2012 was 1068.47 ha. Overall, there was a very high level of adoption intensity (0.782). Adoption intensity was calculated by dividing total area of land devoted for each practices by total land area under onion production.

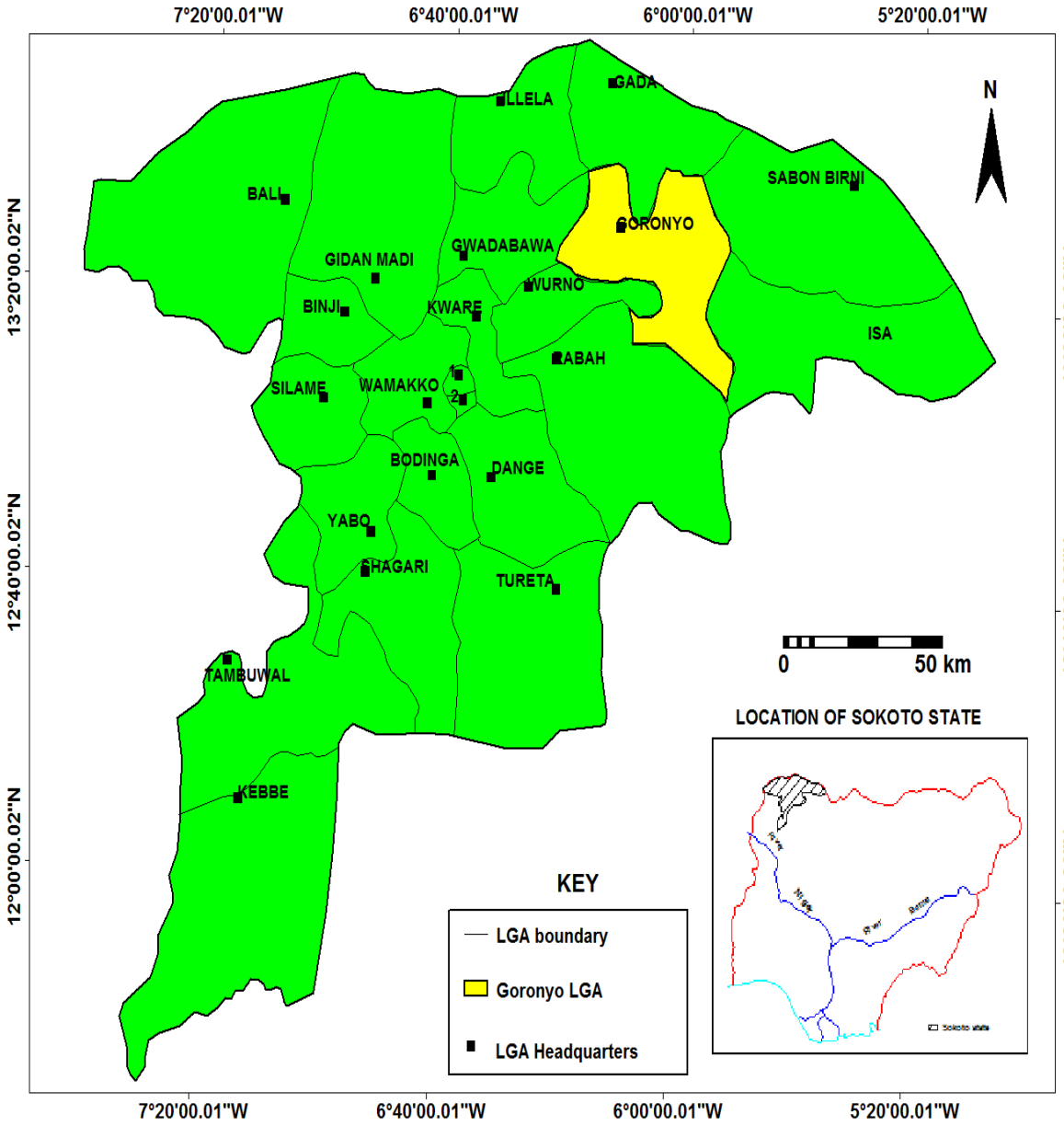


FIGURE: 2 SOKOTO STATE SHOWING GORONYO LOCAL GOVERNMENT AREA

Source : Adapted and Modified from Administrative Map of Sokoto State

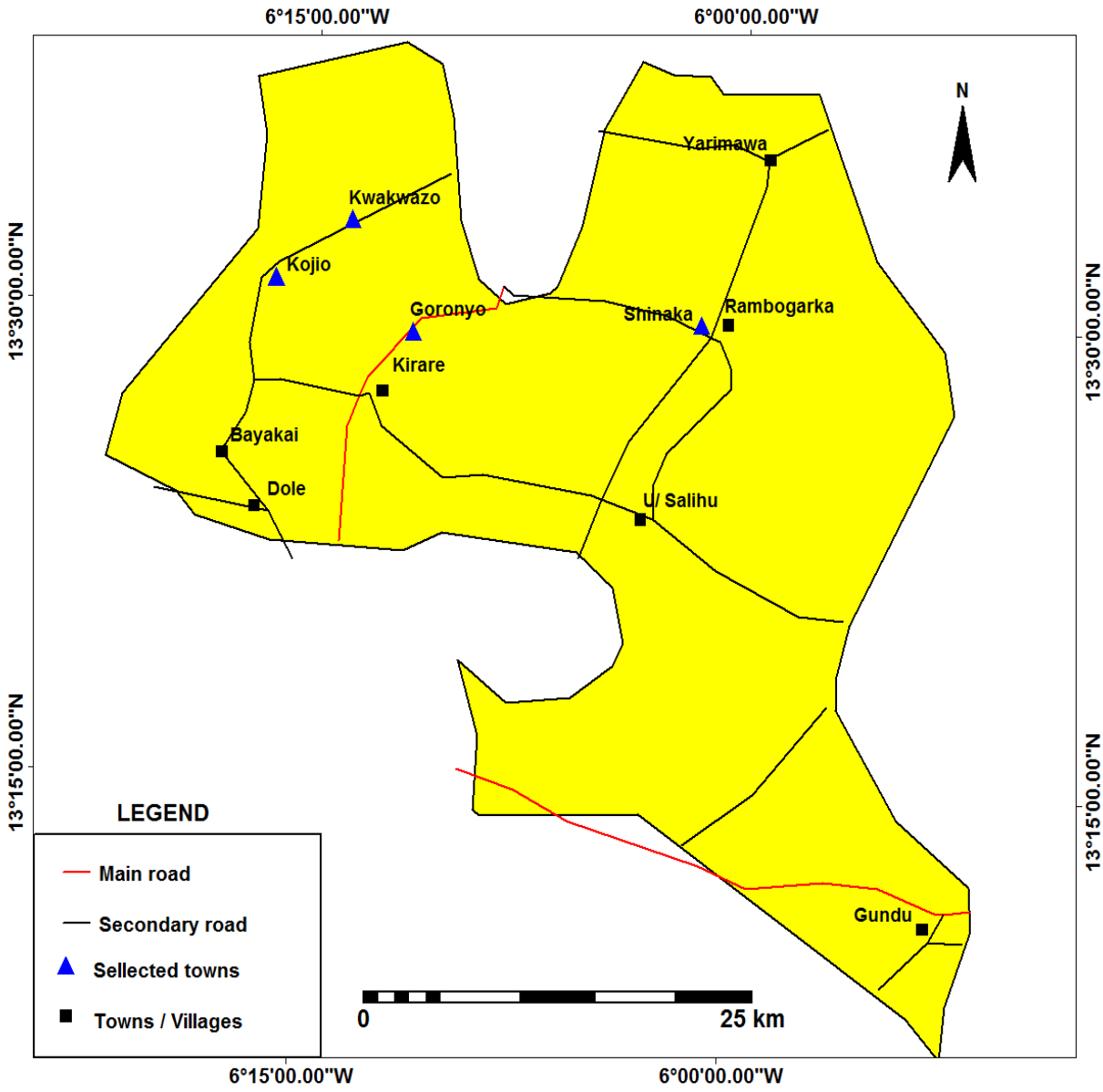


Figure: 3.1 **GORONYO LOCAL GOVERNMENT AREA SHOWING SELECTED VILLAGES**

Source : Modified from Administrative Map of Sokoto State

3.2 Sampling Procedure and Sample Size

A multi - stage sampling procedure was used. The target population of the study is onion producers in Goronyo Local Government Area (LGA), therefore, first a purposive sampling procedure was used in selecting 4 (four) villages known to be intensively involved in onion production in the LGA. These villages which are already known due to the researcher's previous knowledge of the area are Kojio, Shinaka, Goronyo and Kwakwazo. From these villages, a list of all onion farmers was compiled with the help of the Extension worker in charge of the LGA and the village heads of these villages. Random sampling technique was used to select onion farmers from each of the villages, thus giving a total of 120 farmers as sample size out of 995 onion farmers in the study area. Ballot system was employed to select the respondents, papers were numbered, squeized and rolled so that all the farmers have equal chance of being selected.

The final stage involved random selection of respondents at 12% from the sampling frame of those villages and 12% was used to get effective representation of the total population. The sampling frame was the list of onion farmers compiled during the reconnaissance surveyed (Table 3.1). A total sample size of 120 out of 995 sample frame was used to elicit farm level data for the analysis.

Table 3.1: Distribution of Sampled Respondents in the Study Area

Name of LGA	Selected villages	Sample frame	Sample size (12%)
Goronyo	Goronyo	350	42
	Shinaka	250	30
	Kwakwazo	180	22
	Kojio	215	26
Total		995	120

3.3 Data Collection Techniques

Primary data were used for the purpose of the study. The Primary data were obtained through field survey using structured questionnaire. The questionnaire was administered to the sampled onion farmers in the study area with the help of trained enumerators. The questionnaire was administered when farmers were less busy, and the head of the house hold was the respondent.

3.4 Tools of Analysis

Descriptive statistics such as means, standard deviations, percentages and frequency distribution was used to achieve objective i, ii, iii iv and vii. Regression analysis was used to test the hypotheses to achieve objective v; i.e. factors influencing adoption of recommended onion production practices in the study area and Analysis of Variance (ANOVA) was used to achieve objective vi; i.e. the effects of adoption of recommended of recommended onion production practices on output, income from onion production and level of living of the farmers.

One way analysis of variance (ANOVA) was used to analyze the data on the effects of adoption of recommended of recommended onion production practices on output, income from onion production and level of living of the farmers which were used to formulate hypotheses ii-iv.

The ANOVA is a statistical technique that compares the difference in more than two means. It breaks down the sources of difference between and within the means and sources of the differences. The model is represented as follows:

$$\textit{Between the villages means sum of squares} = \frac{\textit{Between the village difference } (SS)}{\textit{Degree of freedom between the villages}} \quad \text{(i)}$$

$$\textit{Within the villages means sum of squares} = \frac{\textit{Within the village difference } (SS)}{\textit{Degree of freedom within the villages}} \quad \text{-(ii)}$$

Between the village difference (SS); where SS= sum of squares between the villages calculated as;

$$\frac{\Sigma(\Sigma xi)^2}{n} \quad - \quad \frac{(\Sigma\Sigma xi)^2}{N} \quad \text{----------(iii)}$$

Within the village difference (SS); where SS= sum of squares within the villages calculated as;

$$\Sigma\Sigma xi^2 - \frac{\Sigma(\Sigma xi)^2}{n} \quad \text{----------(iv)}$$

$N = n_1 + n_2 + n_3$; Where:-

n= number of observations per village.

N= number of all observations of the villages. i.e. $N=n_1+n_2+n_3+n_4$.

$\frac{\sum(X_i)^2}{n}$ = Total of x_i's of each village whole square divided by the

n = number of observations of that village.

$\frac{(\sum\sum(x_i))^2}{N}$ =Total of x_i's of all the four village of all the observations.

$\sum\sum x_i^2$ = Total of x_i^2 of the four villages.

Degree of freedom:

Between the villages = k-1

K (Number of villages) -1=4-1=3

$$F = \frac{\textit{Between the villages means sum of squares}}{\textit{Within the villages means sum of squares}} \quad \text{----------(v)}$$

Decision rule

When Fcal > Ftabular; reject the null hypothesis

Fcal < Ftabular; accept the null hypothesis.

Note:

Formula for the one way ANOVA

The simplified formulas for ANOVA, there are 3 key words

- Total Sum of Squares (TSS)
- Sum of Squares Columns (between or among) (SSC)
- Sum of Squares within (Error) (SSE)

The alternative ANOVA formula can be illustrated as shown below:

Source of Variation	**Sum of Squares (SS)**	**d.f**	**Mean Square (MS)**	**F-Ratio (F)**
SSC	$\sum_{J=nj}^{N}\left(Y - \bar{Y}\right)^2$ SST –SSE	$N - 1 = V_1$	$\sum_{\frac{j\ nj}{N-1}}^{N}\left(\bar{Y} - \bar{Y}\right)^2 = \frac{SSC}{d.f}$	
SSE	$\frac{N}{\Sigma}\Sigma^{n}\left(Y_{jj} - \bar{Y}_{v}\right)^2$ = SST –SSC	$n - N = V_2$	$\Sigma\Sigma^{N\ n}\frac{\left(\underset{ij}{Y} - \underset{J}{\bar{Y}}\right)}{n-N}$ = SSE/d.f	$\frac{\frac{MSC}{MSE}}{\frac{SSC/d.f}{SSE/d.f}}$
SST	$\underset{i}{\Sigma}\ \underset{ix^2}{\Sigma}\left(Y - \bar{Y}_{ji}\right)^2$	$n - 1$	SSE/d.f	

The multiple regression model is explicitly specified as:-

$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 \ldots\ldots b_{13} x_{13} + u$

Where:-

Y= Adoption of recommended onion production practices was measured (total no. of recommended onion production practices adopted by the respondent).

X_1 = Age (in years)

X_2 = Level of education (Number of years in formal schooling)

X_3 = Farmers experience (number of years in onion production)

X_4 = Household size (number of people in household)

X_5 =Labour (number of people available in household for onion production)

X_6 = Farm size (ha)

X_7 =Awareness level (Yes = 1, No = 0)

X_8= Credit received (amount in Naira received)

X_9= Membership of cooperatives (number of cooperatives a farmer belongs to at the time of the study)

X_{10} Extension contact (number of visits the respondents received in the 2012)

X_{11} = Affordability (Very Expensive=4, Expensive=3, Cheap=2 and Very Cheap=1).

X_{12} = Compatibility (Strongly Disagreed=5, Disagreed=4, Undecided=3, Agreed=2 and Strongly Agreed=1)

X_{13} = Complexity (Agreed=3, Undecided=2 and Disagreed=1)

U = Error term

a = Constant

b_1- b_{13} = Regression coefficients

3.5 Operationalization and Measurement of Variables

3.5.1 Measurement of independent variables

a) Age (in years) (x_1): This indicates how old the respondent is. Younger farmers with fewer numbers of years are likely to adopt the technology than the older ones. It was measured in number of years as reported by the respondent at the time of data collection.

b) Level of education (x_2): The more educated the farmers are, the more likely they adopt the onion technologies. Level of education was measured by number of years spent in formal schooling.

c) Farming experience (x_3): The more the numbers of year's farmers spend in onion production the more willing to adopt the innovation. This variable was measured in years according to the number of years of each respondent in onion production.

d) Household size (x_4): This is measured in terms of number of people in a household. The larger the household size the more favorably disposed will be the members to adopt the recommended onion production practical. This was measured based on the number of wives, children and dependants a respondent has living with him at the time of the study.

e) Labour availability (x_5): The more available labour is the more likely for the farmers to adopt the innovation. It was measured in man days or man hours working in the farm.

f) Farm size (x_6): Refers to the total area of the farm in hectares operated by the respondents and included in the model to confirm or reject the assumption that the larger the size of the farm the more feasible it is to adopt the technology package. It was measured in hectares.

g) Level of awareness (x_7): The more farmers are aware about an innovation, the more likely they will adopt it and vice versa. It was measured by the total number of Recommended Onion Production Practices (ROPPs) that the respondent is aware. (aware = 1, not aware = 0)

h) Access to credit (x_8): The more farmers access to credit facilities the more likely for them to adopt innovation. This was measured in naira as credit obtained.

i) Membership of cooperatives (x_9): The more farmers are involved in designing a project the more likely for them to adopt the technology. It was measured by the total number of cooperative societies/community organizations the farmer belongs to at the time of this study.

j) Extension contact (x_{10}): The more number of visits of an extension agent to the farmers the more likely for them to adopt innovation. It was measured by the total number of times a farmer is visited in connection with improved onion production.

k) Affordability (x_{11}): The more affordable the technology is the more likely farmers adopt it. This was measured in this study by the use of a 4-point likert scale: very Expensive = 4, Expensive = 3, Cheap = 2 and very cheap = 1.

l) Compatibility (x_{12}): Technology that is compatible with the norms and values of the society are likely to be adopted by the farmers. This was measured by the degree of compatibility using a 5 – point Likert scale (strongly disagree = 5, disagree = 4, undecided = 3, agree =2 and strongly agree = 1)

m) Complexity (x_{13}): Technologies that are difficult are not likely to be adopted by the farmers. This was measured by using 3-point Likert scale Agreed = 3, Undecided =2 and Disagreed = 1.

3.5.2 Measurement of dependent variable

a) Adoption of recommended practices

The dependent variable is adoption of recommended onion production practices. These recommended practices include:

i. Varieties: (Kano red, Wuyan Bijimi, Ex-Dala, Ex-Hunkuyi (high yielding), DS 79, Maiduguri Improved, composite I (stores well), Red creole, Pusa Red etc.),
ii. Spacing: (15 x 20cm within each row. Beds are more popularly used and plants are spaced at 15 x 15cm to 20 x 20cm),
iii. Planting method: (by seeds or sets), Sow in late April, transplant in mid-June and harvest in August/Sept., Sow in late June, transplant in July/August and harvest in Nov/December., Sow in Sept/Oct, transplant in Nov/Dec. and harvest in March/April) ,
iv. Weed management: (The field should be kept free during the first 10 – 12 weeks of growth. Special tiny – bladed hoes are used for weeding),
v. Transplanting: (Mid-June)
vi. Fertilizer application: (About 20 – 25t/ha of FYM should be applied or in the absence of such 300kg NPK (15 – 15 – 15) can be applied in 2 equal split doses. The first fertilizer application should be at land preparation and the remainder at 3—4 WAT.
vii. Disease control: (Toxiphan, Malathion, Heptachlor, Dieldrin or Parathiou. Improved field sanitation, early planting, avoidance of flooded areas, proper row orientation, and use of resistant varieties and finally spraying with chemicals),
viii Harvesting: (Onions are hand pull and kept in a shelter. Bulbs are left in the shelter to cure for two weeks)
viii. Storage: (Mechanical cold storage (refrigerated).

Nine (9) recommended onion production practices were studied. An adopter is a farmer who uses any of the Recommended Onion Production Practices (ROPP) on a continous and relatively large scale basis. A farmer who reported that he/she used a particular recommended practice on a continous basis, is only upon an indication of satisfactory (2/3) explanation of the scale of usage that he will be credited as an adopter. This will be facilitated by describing in the questionnaire how each recommendation is expected to be used, so that the interviewers could check to ensure the validity of the recorded information. The adoption score for each farmer will be calculated by summing up the number of practices he reported being adopted (Sadiq, 2012).

b) Adoption intensity

In crop-based adoption studies, adoption intensity (A) is defined as

$$\text{Adoption intensity } (A_i) = \frac{\text{Total land area of crop under technology (ha)}}{\text{Total land area under the same crop (ha)}}$$

In this study which works with a treatment group (farmers who adopt) and a control group (farmers who did not adopt), it concentrates on the measurement of adoption intensity for the treatment group only.

Adoption measurement shall be computed based on individuals response of Yes which will be scored ‘one’ or No to be ‘zero’ as to whether recommended onion production is being practiced at the time of this study.

3.5.3 Outcomes

Output of onion: This was measured as total output of improved onion in 100 Kg bags obtained during the 2012 cropping season

Onion yield: This variable was measured as the total output of improved onion in 100 kg bags obtained by the farmer during 2012 cropping season divided by total hectares of land under onion production.

Income from onion production: In this study farm income refers to the total money realized from the sales of onion in 2012 by the farmer. This was measured in naira (#).

Level of living: For the purpose of this study, level of living refers to all things contributing to the quality of human life. Thus, level of living was measured by the value of durable goods, farm equipment, buildings, ownership of vehicles, number of meals per day, quality of meal and livestock possession of an individual farmer. Durable goods items to be considered are: bus/pick-up, motor cycle and bicycle. The livestock purchased with money from onion production will be: cow, donkey, horse, goat, and sheep, while, farm equipment will be: ox-plough and hand plough.

The respondent was asked to indicate the price of each item at the time of the interview if the item can be sold in order to get a realistic monetary value. Amounts of all items was summed up and added to form an income to get the individual respondent's level of living.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Farmer's Socio-economic Characteristics and Institutional Factors

4.1.1 Farmer's socio-economic characteristics.

Objective one of the study was to identify the socio-economic characteristics of onion producers in the study area. Table 4.1 shows the distribution of the respondents according to their age. About 35.00% of the farmers fall within the age range of between 41 – 50 years. This shows that most of the respondents are relatively middle aged, which could be regarded as active and productive age group and so have the energy to cope with the rigors of onion production and also willing to experiment with newly introduced production practices. The result supports the opinion of Ekong (2003) which proved that farming in Nigeria is dominated by older farmers especially between ages 41 – 50. It also agrees with the findings of Sadiq (2012) who reported that about 45% of the cotton farmers fall within the age range of between 41 – 50 years.

The findings of this work also agrees with the findings of Ahmadu (2009) which indicated that farmer's ages influence adoption of recommended fish farming in several ways. Table 4.1 also shows the distribution of the respondents by their gender.

The findings reveal that 100% of the farmers were males. This is in line with the findings of Sabo and Dia (2009) who reported that majority of the vegetable farmers interviewed were male, married and polygamous. It also supported the findings of Afolabi (2008) who found that 84.17% of the respondents were males. The dominance of farming by males may be due to crude implements and strenuous activities involved in farming in the study area. This is in contrary with the findings of Agboola (2004)

who reported that rural women in Southern Nigeria provided up to 70% of labour required for dry season vegetables farming. In the same vein Gochwoski and Ngoomba (1999) and Lumpin and Weinberger (2003) reported preponderance of women farmers in vegetable production in Southern Cameroun and Tanzania.

The domination of males in onion production in the study area could be attributed to the fact that males have access to the land and other resources. It could be due to the culture of the respondents in the study area and this suggest that males carried more load than their female counter-parts, who were kept in-doors for child bearing rearing and also caring of homes. The findings of this research work is also in contrary with the findings of Olayemi *et al.* (2011) who found that farming in all zones is largely practiced by females (77.3%). This corroborates the findings of a study commissioned by the United Nations Development Programme (UNDP) which revealed that women make-up some agricultural labour force in Nigeria (World Bank, 2003).

Table 4.1 further reveals that 99.17% were married, while only 0.83% of them were single. This could be due to struggle to meet the needs of their families. This is similar with the findings of Afolabi (2008) who indicated that 95% of the respondents he interviewed were married while 5% were single which can have positive effect on labour. This is also in agreement with Abgamu *et al*. (1996) who reported that married farmers adopted new varieties of maize and cassava more than farmers that are single.

Household size is one of the major indicators/determinants of social status of a farmer, which in turn influence the farmer's ability to adopt modern production practices in farming. Household size response on this variable indicates that 27.50%and 24.17% of

the respondents respectively had between 6 – 10 and 16 – 20 numbers of people in their families (Table 4.1). This implies that the respondents had medium household size which could be used as source of labour for onion production.

The level of education of the respondents is shown in table 2. The Table showed that majority (56.70%) of the respondents had Kor'anic education, while 15%, 10%, 9.20%, 4.20% had Adult education, Secondary education, Primary education and Tertiary education, respectively. About 5.00% of the respondents had no formal education. This findings is in line with the finding of Yusuf (2009) who found that in Kaduna, the highest level of education of the respondents is Islamic education. This could be due to the fact that Koranic education is highly emphasized in the study area.

On the variable relating to farming experience, Table 4.1 shows that 51.67% of the respondents had been in onion production for above 15 years, while 33.33%, 8.33 percent, and 6.67% had been in onion production for between 6 – 10 years, 11 – 15 years and 1 – 5 years, respectively. This suggests that the respondents would not have many problems in adopting the recommended onion production practices. This supports the findings of Sanni (2009) who reported that experience in fish farming influenced the adoption of recommended fish production practices and lead to high economic return. The findings of this research work, however, is in contrast with the findings of Sadiq (2012) who found that 3.47% had been in cotton production for 21 – 25 years which was the least percentage. The assumption is the more the number of years a farmer spent in onion production; the more willing he will be to adopt the recommended practices.

Table 4.1: Distribution of respondents by their socio-economic characteristics

Items	Frequency	Percentage
Age		
21 – 30	9	7.50
31 – 40	38	31.67
41 – 50	42	35.00
Above 50	31	25.83
Mean=45.69		
Total	**120**	**100.00**
Sex		
Male	120	120
Female	0	0.0
Total	120	100
Marital status		
Married	119	99.17
Single	1	0.83
Total	**120**	**100.00**
Household size		
1 – 5	23	19.17
6 – 10	33	27.50
11 – 15	26	21.67
16 – 20	29	24.17
21 and above	9	7.50
Mean=12.28		
Total	**120**	**100.00**
Educational qualification		
No formal education	6	5.00
Adult education	18	15.00
Koranic education	68	56.70
Primary educatory	11	9.20
Secondary educatory	12	10.00
Tertiary education	5	4.20
Total	**120**	**100.00**
Years of formal education		
7-13	2	7.14
Above 13	26	92.86
Total	**28**	**100.00**
Years of farming experience		
1 – 5	8	6.67
6 – 10	40	33.33
11 – 15	10	8.33
Above 15	62	51.67
Mean=16.90		
Total	**120**	**100.00**

Membership of cooperatives

Table 4.2 reveals that 70% were Members of cooperatives. It was also found that onion farmers did not spend the same number of years in such cooperatives, where more than half of the respondents (40.48%) had 1 – 5 years of membership of cooperatives, while 19.17% of the respondents had 6 – 10 years of membership of cooperatives, 22.50 % of the respondents had above 10 years of membership.

It is expected that respondents with high number of years in social organizations would influence their farming activities positively. Table 4.2 further reveals that 65.48%, and 34.52% belong to 1-3 number of cooperatives, above three cooperatives respectively.

Table 4.2: Distribution of respondents based on their membership of associations

Membership of Associations	**Frequency**	**Percentage**
Member	84	70.00
Non-member	36	30.00
Total	**120**	**100.00**
Number of cooperatives		
1-3	55	65.48
Above 3	29	34.52
Total	**84**	**100.00**
Year of Membership of cooperatives		
1– 5	34	40.48
6 – 10	23	19.17
Above 10	27	22.50
Mean=6.23		
Total	**84**	**100.00**

4.1.2 Institutional variables

Level of extension contact by farmers

Table 4.3 shows that majority 68.30% of the respondents had contact with the extension agents, while 31.67% had no extension contact at all. Table 4.3 also shows that majority of the respondents 68.29% met with the extension more than 6 times, 19.50% met with the extension agents 4-6 times, 12.20% met with extension agents between 1-3 times. This may result to inefficient use of the recommended practices. This is in line with the findings of Yusuf (2009) who found that poor extension contact affected the use of recommended technologies among women in Kaduna State.

Table 4.3: Distribution of the respondents based on their extension contact and number of visits

Items	Frequency	Percentage
Extension contact		
Contact	82	68.30
No contact	38	31.67
Total	120	100.00
Number of visits (n=82)		
1-3	10	12.20
4-6	16	19.51
Greater than 6	56	68.29
Total $\bar{X} = 3.43$	**82**	**100.00**

Table 4.4 shows that about 25.80 percent of the respondents that had access to credit received only a mean credit of ₦38,708.33. Also 74.20 percent had no access to credit facilities. This will adversely affect the farmer's productivity.

Table 4.4: Distribution of respondents based on their accessibility to credit and amount of credit obtained.

Items	Frequency	Percentage
Accessibility of Credit		
Accessible	31	25.83
Not accessible	89	74.17
Total	**120**	**100.00**
Amount of Credit Obtained		
1 – 20,000	1	3.33
20,001 – 50,000	4	12.90
50,001 – 80,000	3	9.68
80,001 – 110,000	1	3.33
Greater than 110,000	22	70.97
Total $\bar{X} = 38,708.33$	**31**	**100.00**

4.2 Level of awareness and adoption of ROPPs

Table 4.5 shows that improved onion varieties had an awareness of 80.00%, spacing 77.50%, planting methods 81.67%, weed management 6.67%, transplanting 50%, fertilizer application 82.50%, disease control 86.67%, harvesting 79.12% and Storage 39.17% respectively. This is similar with the findings of Kubde *et al.* (2000) who found that majority of potato growers had complete knowledge about recommended varieties. This finding also supported the findings of Sophia (2001), who found that 80.00 percent of the respondents had medium knowledge levels regarding sustainable cultivation of Sugarcane.

Table 4.5: Distribution of respondents according to their level of awareness of ROPPs

Recommended onion PPs	Awareness		Percentage
	Aware	Not aware	
Improved Onion varieties	96 (80.00)	24	80.00 (20.00)
Spacing	93 (77.50)	27	76.00 (22.50)
Planting method	98 (81.67)	38	82.00 (31.67)
Weed Management	8 (6.67)	120	100 (100.00)
Transplanting	60 (50.00)	70	50.00 (58.33)
Fertilizer application	99 (82.50)	37	83.00 (30.83)
Disease control	104 (86.670	60	87.00 (50.00)
Harvesting	95 (79.12)	21	79.00 (17.50)
Storage	47 (39.17)	73	39.00 (60.83)

Figures in parentheses are percentages.

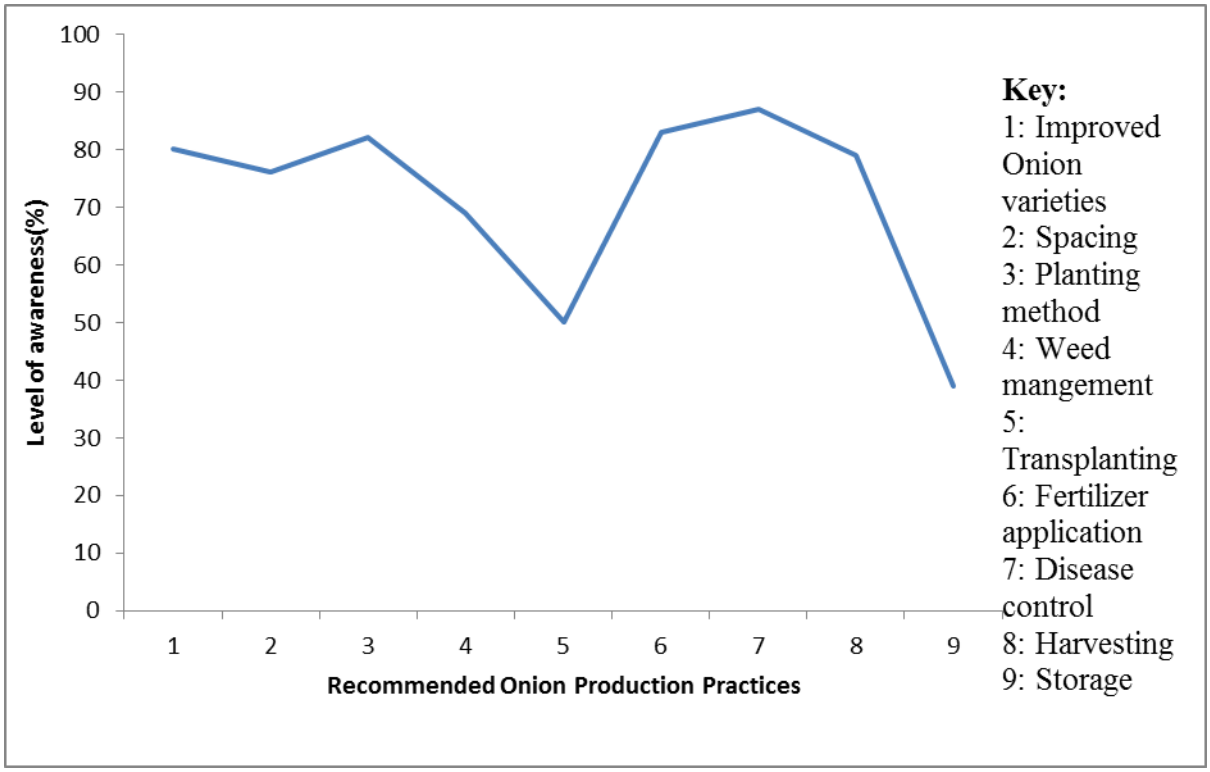


Figure 4.1: A graphic representation of ROPPs showing level of awareness

4.2.1 Rate of adoption

The third objective of this study was to determine the level of adoption and rate of adoption of recommended onion production practices by the farmers. The recommended practices were introduced to the farmers in the study area in 2000. However, the analysis in this study is from the year 2000-2001 to 2010-2011.

The result in Table 4.6 shows that in 2000-2001, improved onion varieties had 40.00% rate of adoption, spacing 55.00%, planting method 27.00%, weed management 45.00%, transplanting 61.00%, fertilizer application 18.00%, disease control 55.00% and harvesting 18.00%. In 2002-2003 improved onion varieties and fertilizer application had the same rate of adoption of 58.00% and weed management having the highest rate of adoption of 59.00%. This could be due to the availability of farm inputs in that year. In the year 2004-2005, there was a fall in the rate of adoption of the ROPPs with planting method having the highest rate of adoption (59.00 %). This could be due to unavailability of farm inputs or high cost of farm inputs and poor market price or due to pests and diseases. Almost the same experienced in 2006-2007 and 2008-2009. However, there is a little improvement in 2010-2011 which could be due to availability of farm inputs and labour availability in the study area.

Figure 5 shows rise and fall pattern of the rate of adoption of ROPPs by the farmers in the study area. The implication of this finding is that farmers are likely to adopt many of the recommended practices in certain time and drop some of them in another time. This could be due to many factors such as change in price of onion, disease and pest's damage and change in government policy.

Table 4.6: Distribution of the respondents according to the rate of adoption of recommended onion production practices

Recommended Onion production practices	**Rate of adoption (%)**					
	2000-01	**2002-03**	**2004-05**	**2006-07**	**2008-09**	**2010-11**
Improved onion varieties	40.00	58.00	41.00	48.00	62.00	62.00
Spacing	55.00	20.00	42.00	24.00	30.00	32.00
Planting method	27.00	22.00	59.00	42.00	12.00	40.00
Weed management	45.00	59.00	20.00	43.00	30.00	35.00
Transplanting	61.00	30.00	48.00	68.00	52.00	49.00
Fertilizer application	18.00	58.00	15.00	47.00	22.00	39.00
Disease control	55.00	10.00	42.00	58.00	52.00	61.00
Harvesting	18.00	58.00	17.00	22.00	31.00	30.00
Storage	00.00	00.00	00.00	00.00	00.00	00.00

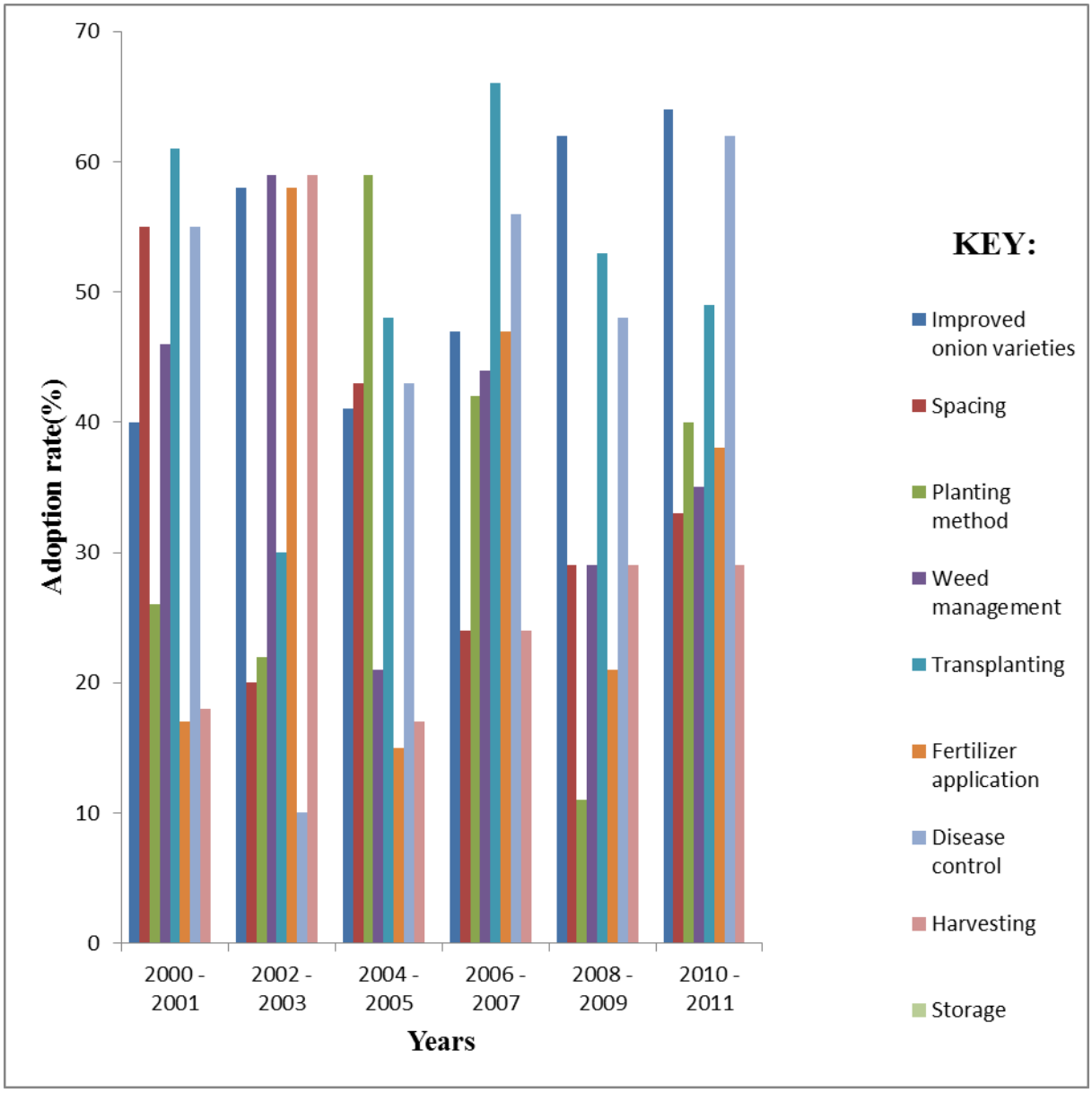


Figure 4.2: A graphic representation of ROPPs showing rate of Adoption

Adoption Intensity of ROPPs

Table 4.7 shows the distribution of the respondents based on their adoption intensity of recommended onion production practices.

The result in Table 4.7 shows that improved onion varieties had an adoption intensity of 0.070, spacing 0.130, planting method 0.093, weed management 0.093, transplanting 0.042, fertilizer application 0.143, disease control 0.112 and harvesting 0.092 respectively. These figures show a low level of adoption intensity. This may be as a result of lack of technical knowhow, or expensive of the machine, it could also be due to power failure as we all know that light in our country faced a lot of problems and the storage method for this production require regular power supply for it to function effectively.

Table 4.7 Distribution of the respondents based on their adoption intensity of recommended onion production practices.

Recommended Onion PPs	**Total Area of land devoted for each practices**
Improved onion varieties	0.070
Spacing	0.130
Planting method	0.093
Weed management	0.093
Transplanting	0.042
Fertilizer application	0.143
Disease control	0.112
Harvesting	0.092
Overall	**0.782**

4.3 Factors Influencing Level of Adoption of Recommended Onion Production Practices

The fifth objective of this study was to identify the factors influencing adoption of recommended onion production practices in the study area. This was achieve by testing the hypotheses drawn for this study, through the use of multiple regression model to analyse the socio-economic and institutional variables as well as the ROPP's attributes influencing its adoption.

Hypothesis I: The first hypothesis was that there is no significant relationship between socio-economic characteristics of the farmers, institutional variables and attributes of recommended practices and adoption of recommended onion production practices. The result of multiple regression analysis in Table 4.8 shows that age of the respondents had a negative coefficient (-.026) and significant at 10% level of probability. This implies that age is inversely related to the adoption of ROPPs but with significant influence. This implies as farmers ages increase, the rate of adoption will decrease. This is in line with the findings of Ahmadu (2009) who reported that farmers age influence the adoption of recommended fish farming in several ways.

Farming experience had a negative coefficient (-.039) and significant at 10% level of probability. This implies that farmers with high farming experience adopt ROPPs more than the inexperience farmers. This is in line with the findings of Unuigbe (2011) who found that farming experience had a negative coefficient (-0.483) and have inverse contribution to the adoption of the recommended practices. This is in contrary with the findings of Chikezie (2010) who reported that farming experience had a positive coefficient (.136). Table 4.8 also shows the amount of credit obtained by the respondents had a positive coefficient (0.062) and significant at 5% level of probability.

This is in contrary with the findings of Sadiq (2012) who reported that amount of credit received by the respondents had a positive coefficient but insignificant. The absence of credit facilities compels the farmers to borrow money from money lenders at a very high interest rate.

Extension contact was found to have a positive coefficient (0.015) and positively contributes to the adoption of ROPPs. This implies that the higher the number frequency of visits of extension agents to the farmers, the higher the level of adoption of ROPPs. It is in line with the findings of Chikezie (2010) who found extension contact to be significant. Farmers with low or no extension contact with extension agents may not adopt any farm innovations because they may not be aware. Awareness is a necessary step in the process of adoption of farm innovations. Before any technology is adopted, it must pass through the process of adoption (Rogers and Shoemaker, 1971).

Farm size had a negative coefficient (-.031) but not significant. This implies that farmers with larger farm size adopt ROPPs more readily than those with smaller farm sizes. This is in line with the findings of Ogunfidimi (1981) who reported a negative relationship between farm size of cassava and adoption in a study of rural areas in Oyo and Ondo states, Nigeria. This is also in contrary with the findings of Maiangwa (2006) who found farm size to be positively related to adoption of agro-forestry in Rano and Ajiwa, and negative in Danbata and Funtua Zones, in North West zones of Nigeria. Complexity was found to had a negative coefficient (-.017) and significant at 10% level of probability.

This implies that the complexity is inversely related to the adoption. This implies that farmers resist agricultural technologies that are difficult to understand. This finding

concurred with the findings of Ani *et al.* (2008) who found that farmers easily understand and adopt less complex recommended practices.

Compatibility was found to have a positive coefficient (0.417) and significant at 1% level of probability. The positive and significant relationship between compatibility indexes implies that the more compatible of a technology with farmers needs, values and existing system, the higher the adoption of ROPPs.

House hold size was found to have negative coefficient (-.048) and significant at 10% probability level .Household size, the size of holding is one of the major indicators/determinants of social status of a farmer which in turn influence the farmer's ability to adopt modern farming techniques. The findings show that household size was important factor in the adoption of ROPPs. This is in contrary with the findings of Uniugbe (2011) who found insignificant correlation with adoption of natural rubber farm innovations. He added that, a reason for this might be that large household size may not adopt labour saving farm innovations, because they are self sufficient in labour needs. Awareness was found to have a negative coefficient (-.048) and significant. This implies that the more farmers are aware of recommended practices, the more likely they adopt it although awareness here was inversely related to the adoption of ROPPs.

Labour was found to have a negative coefficient (-.032) and not significant. This corroborates with the findings of Sadiq (2012) who found that labour had a negative coefficient but not significant. This implies that labour is a source of discouragement to the adoption of ROPPs. This agrees with the findings of Benjamin (2010) who discovered that farmers resist agricultural technologies that required high labour use.

Membership of cooperatives had negative coefficient (-.008) and not significant. Although inversely related to the adoption of ROPPs, membership of social organizations (Cooperatives) was important in inducing famers to adopt the ROPPs. This is in contrary with the findings of Chikezie (2010) who reported that membership of social organization had a positive coefficient (.107) but not significant. In the same vein, Ojo (2009) reported an insignificant influence of cooperatives membership and amount of credit received on adoption of recommended cassava production practices.

Table 4.8 also reveals a positive coefficient (.001) of educational level of the respondents. This implies that the higher the educational level of the respondents the higher the adoption of ROPPs. This supported the work of Sadiq (2012) who reported a positive coefficient (.0227) at 5% level of probability. This also corroborates with the findings of Chikezie (2010) who reported that education had a positive coefficient (.068) and Uniugbe (2011) observed a positive coefficient (.333) and significant. The positive and significant relationship between formal education and adoption implies that the higher the level of formal education the higher the adoption of natural rubber production recommendations. This corroborates with the findings of (Atala, 1980; Voh, 1982; Igbokwe, 2000 and Onomolease *et al.,* 2001).

Table 4.8 shows that Affordability had a positive coefficient (.024) and not significant. This implies that the lower the cost of the ROPPs to the farmers the high its adoption. This agrees with the findings of Ojo (2009) who found a positive contribution of technology affordability to adoption of recommended cassava production practices. It was hypothesized that there is no significant relationship between socio-economic characteristics of the farmers, institutional variables and attributes of the recommended

practices and adoption of recommended onion production practices. The result of multiple regression analysis revealed that farming experience, age, farm size, complexity, household size, awareness, labour and cooperatives had negative coefficient at different level of probabilities, other variables had a positive coefficient at different probability levels. The result also shows the contribution of each independent variable to the adoption of ROPPs with an R^2 value 75%. This implies that all the variables together explained about 75% of the variability in adoption of ROPPs in the study area.

This implies that the model gave good fit of the data. The null hypothesis was rejected and the alternate hypothesis accepted; that is the respondent's socio-economic characteristics, institutional variables and attributes of the recommended practices have significant influence on the adoption of ROPPs.

Table 4.8: Multiple regression result of the factors influencing adoption of recommended onion production practices

Variable	Coefficient	Standard error	T-value
Farming experience	-0.039*	0.023	-1.696 S
Credit	0.62**	0.027	22.963 S
Age	-0.026*	0.022	-1.182S
Extension contact	0.015	0.018	0.883 NS
Farm size	-0.031	0.118	-0.262 NS
Complexity	-0.017*	0.009	-1.889 S
Compatibility	0.417***	0.060	6.9750 S
Household size	-0.048*	0.026	-1.846S
Awareness	-0.032	0.042	-0.762 NS
Labour	-0.015	0.026	-0.577 NS
Cooperative	-0.008	0.043	-0.186 NS
Education	0.001	0.000	0.001N S
Affordability	0.024	0.147	0.166 NS

*** P<0.01; ** P<0.05; * P<0.10
R = 0.371
R^2 = 0.75 = 75%
S=significant
NS= not significant

4.4 Analysis of Variance (ANOVA) showing Output, Income and Level of Living of the Onion Farmers

4.4.1 Analysis of variance (ANOVA) Output

F – calculated was 1.056 which is smaller than F - table (2.683). Therefore, the null hypothesis was accepted, while alternative hypothesis was rejected. This implies that, there is no significant relationship in the output of the onion farmers across the four villages sampled in the study area. The farmers had the same output across the four villages as reported by them during the time of the study.

Table 4.9: ANOVA Table showing output of the onion farmers in the four villages of the study area

Source of variation	SS	Df	MS	F	P-value	Fcrit
Between Groups	3.23E+09	3	1.08E+09	1.055585	0.370879	2.682809
Within Groups	1.18E+11	116	1.02E+09			
Total	1.22E+11	119				

4.4.2 Analysis of variance (ANOVA) Income

F- calculated was 4.998 which is greater than the F-table (2.603). Therefore, the null hypothesis was rejected, while the alternative hypothesis was accepted.

This implies that, there is significant relationship in the income of the onion farmers across the four villages sampled in the study area.

Table 4.10: ANOVA Table showing income of the onion farmers in the four villages of the study area

Source of Variation	SS	Df	MS	F	P-value	Fcrit
Between Groups	2.83E+12	3	9.41E+11	4.998002	0.002694	2.682809
Within Groups	2.18E+13	116	1.88E+11			
Total	2.47E+13	119				

4.4.3 Analysis of variance (ANOVA) Level of Living

F – calculated was 1.791 which is smaller than the F- table (2.683). Therefore, the null hypothesis was accepted, while the alternative hypothesis was rejected.

This implies that, there is no significant relationship in the level of living of the onion farmers across the four villages sampled in the study area.

Table 4.11: ANOVA Table showing level of living of the onion farmers in the four villages of the study area

Source of Variation	SS	Df	MS	F	P-value	Fcrit
Between Groups	3.84E+11	3	1.28E+11	1.791247	0.152703	2.68280
Within Groups	8.28E+12	116	7.14E+11			
Total	8.66E+11	119				

4.5 Yield of Onion

The result reveals that majority (54.17%) of the respondents reported a yield range of 20, 001-50, 000 kg/ha. The result further shows that 27.50 percent of the respondents reported a yield range of between 1- 20, 000 kg/ha. About 13.33% of the respondents reported a yield range of 50, 001 – 80, 000 kg/ha while 5.00% reported a yield range of greater than 80, 000 kg/ha. The result of this finding showed that the respondents had a mean yield of 32175.29 kg/ha (32.175 tonnes/ha) which doubled the mean yield (15 ton/ha) obtained from traditional practices (SADP, 2011). Though the yield obtained from this finding is less than the research potential mean yield of 20-50 ton/ha (Babaji, 2012). It is higher than that of farmers practices (15 ton/ha) it is also within the range of research potential (20-50 ton/ha). This implies that the adoption of ROPPs had increased the yield of the respondents. The implication of this is that the onion farmers in the study area will develop more interest in adopting the components of the recommended practices.

Table 4.12: Distribution of yield performance of the respondents

Items outcome (kg/ha)	Mean yield (tones/ha)	Frequency	Percentage
1-20, 000	32.175	33	27.50
20, 001 – 50, 000		65	54.17
50, 001 – 80, 000		16	13.33
Greater than 80, 000		6	5.00
Total		**120**	**100.00**

4.6 Constraints Encountered by Onion Farmers

Table 4.13 reveals that 59.20% complained of inadequate storage facilities, which in turn affected the income of a farmer negatively, as onion is a perishable product that if not marketed early can easily be spoiled. While 40.80%, 25.00%, 23.30%, 10.00%, 15.00%, 17.50%, 5.80% and 50.80%, 3.30% complained of high cost of labour, high cost of fertilizer, high cost of agro chemicals, inaccessibility to improved seeds, small farm holding, poor extension services, poor market price, inadequate capital and inadequate credit facilities respectively.

In the same vein, Kudi *et al*. (2008) reported that, the major problems emphasized by his respondents were high cost of farm inputs like fertilizer, herbicides and pesticides. Another major area of concern was post harvest problems, the respondents (64%) complained of poor storage facilities and 36% of the respondents complained of poor marketing. In the same vein, Nisar Ali Shah *et al.* (2011) in their paper titled onion production potential and prospect for improvement in the farming systems of Punjab Pakistan reported that there were many factors affecting low yield mainly due to high input prices followed by poor accessibility to quality seed and water shortages. Similarity, Mofoke *et al.* (2003) observed that vegetable production in Nigeria is

characterized by use of crude implements, non-availability of inputs, illiteracy, expensive and complex technologies.

In the same vein Kiresur and Ganesh Kumar (1998) revealed that absence of storage facilities was the major problem expressed by 91.23% of onion growers. The findings of this research work is in line with the findings of Mohaptra (1999) who stated that, due to unavailability of storage go downs, lack of government price for marketing, the farmers were forced to dispose their produce at the lowest possible price, non-availability of adequate institutional credit facilities at right time, compels them to lend money from lenders and middlemen at exorbitant rate of interest which forced to sell at a predetermined price to the traders. Besides social obligations (marriage and other ceremonies) which usually occur after harvest season, were other reasons for early disposal of the products at a lower price.

Shah (1999) also concluded that due to poor storage conditions in terms of ventilation, majority of the onion producers were seem to market produce immediately after harvesting, various marketing intermediaries had certainly taken advantage of this situation. This had undoubtedly led to unremunerative prices offer for most of onion producers.

Moreover, Satendra Kumar *et al.* (2000) found that, high fluctuations in market prices, unavailability of suitable variety, resource poor farmers, inadequate of cold storage and ware – housing facility in the study area coupled with high cost of inputs were the major constraints experienced by the turmeric growers. Waman and Patil (2000) reported that high cost of onion seed and fertilizers was considered as major constraints for onion growers.

Table 4.13: Distribution of the respondents according to constraints faced in the adoption of recommended onion production practices

Constraints	Frequency	Percentage	Order
Inadequate storage facilities	71	59.17	1st
Inadequate capital	61	50.83	2nd
High cost of labour	49	40.83	3rd
High cost of fertilizer	30	25.00	4th
High cost of Agrochemical	28	23.33	5th
Poor extension services	21	17.50	6th
Small farm holding	18	15.00	7th
Inaccessibility to improved seeds	12	10.00	8th
Poor market price	7	5.83	9th
Inadequate credit facilities	4	3.33	10th

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study was designed to determine the factors influencing adoption of recommended onion production practices in Goronyo Local Government Area of Sokoto State, Nigeria.

A multi-stage sampling procedure was used in this study. Random sampling was used to select four villages from the study area. These villages were Shinaka, Kwakwazo, Kojio and Goronyo. The sample size was 120 respondents which were randomly selected. Data were collected from farmers in March, 2013 from 2012 cropping season. Descriptive statistics, multiple regressions and Analysis of Variance (ANOVA) were used to analyse the data.

The first objective of the study was to identify the socio-economic characteristics of onion production farmers in the study area. The socio-economic characteristics: The result showed that 35.00%, 31.67% and 7.50% of the respondents were between the ages of 41 – 50 years, 31 – 40 years and 21 – 30 years, respectively. About 27.50%, 24.17% and 21.67% of the respondents had 6 – 10, 16 – 20 and 11 – 15 numbers of people in their household respectively. The result showed that 99.17% were married, while 0.83% were single. The result showed that 100% of the respondents were males as already stated in the sampling procedure that the head of the house hold will be the respondent, although there could be female headed household. About 56.70% of the respondents had Qur'anic education, while 15% had adult education.

Similarly, 51.67% of the respondents had 15 and above years farming experience while 33.33% had 6 – 10 years farming experience respectively.

The result showed that 70.00% of the respondents had membership of Association, while 30.00% had no membership of associations. About 25.80% had access to credit facilities while 74.20% of the respondents had no access to credit facilitates. The mean credit received of the respondents was N38, 708.33. The second objective of the study was to determine the rate of awareness and adoption of recommended onion production practices in the study area. The result showed that improved onion varieties had an awareness of 80.00%, spacing 77.50%, planting methods 81.67%, weed management 6.67%, transplanting 50%, fertilizer application 82.50%, Disease control 86.67%, Harvesting 79.12% and Storage 39.17% respectively. The third objective was to identify the level of adoption and rate of adoption of recommended onion production practices in the study area. The result showed that in 2000-2001, improved onion varieties had 40.00% rate of adoption, spacing 55.00%, planting method 27.00%, weed management 45.00%, transplanting 61.00%, fertilizer application 18.00%, disease control 55.00% and harvesting 18.00%. In 2002-2003 improved onion varieties and fertilizer application had the same rate of adoption of 58.00% and weed management having the highest rate of adoption of 59.00%. This could be due to the availability of farm inputs in that year. In 2004-2005, there was a fall in the rate of adoption of the ROPPs with planting method having the highest rate of adoption (59.00 %). This could be due to unavailability of farm inputs or high cost of farm inputs and poor market price or due to pests and diseases. Almost the same experienced in 2006-2007 and 2008-2009. However, there was a little improvement in 2010-2011 which could be due to availability of farm inputs and labour availability in the study area.

The fourth objective was to identity the adoption intensity of recommended onion production practices in the study area. The result in figure four shows that harvesting, fertilizer application, planting method, spacing, disease control, weed management, transplanting, improved onion varieties, storage had an adoption intensity of 0.092, 0.143, 0.130, 0.093, 0.093, 0.042, 0.112, 0.070 while storage had zero adoption intensity. This may be due the fact that PHCN in Nigeria is not regular and this storage required a constant power supply which is not very much available in the study area.

The fifth objective of this study was to identify factors influencing level of adoption of recommended onion production practices in the study area. The result of multiple regression analysis shows the influence of socio-economic variables: amount of credit obtained (0.062), farming experience (-.039), age (-.026), complexity (-.017), household size (-.048), compatibility (4.517) and educational level (.001) had significant contribution to adoption of ROPPs. In a similar trend affordability and compatibility had a positive coefficient also influence the adoption of ROPPs significantly.

The sixth objective was to determine the effects of adoption of recommended onion production practices on yield, income from onion production and level of living of the farmers. Result from the Analysis of Variance (ANOVA), shows that there was no significant relationship between adoption of the recommended onion production practices and onion output, and level of living. Therefore, the null hypotheses were accepted and alternative hypotheses were rejected for output and level of living from onion production. For the income null hypothesis was rejected while the alternative hypothesis was accepted.

The seventh objective of this study was to identify the constraints encountered by farmers in the adoption of recommended onion production practices in the study area.

The result showed the ranking of the constraints faced by the respondents in adopting the ROPPs.

Inadequate storage facilities (1), Inadequate capital (2), High cost labour (3), High cost of fertilizer 4), High cost of Agro chemicals (5), poor extension Service, (6) small from holding (7), Inaccessibility to improved seeds (8), poor market price (9) and inadequate credit facilities (10).

5.2 Conclusion

The result shows the contribution of each independent variable to the adoption of ROPPs with an R^2 value (0.75), which implies that all the variables together, explained about 75% of the variability in the adoption of ROPPs in the study area. It is reported that the mean yield of the respondents was 32.175 tonnes/ha. The implication for this is that the ROPPs had increase yield of onion more than traditional practices and this suggests that if the marketing problems are not adequately addressed, there could be the problem of onion glut in the study area, if the farmers appropriately adopt the ROPPs. Consequently this could affect their income and level of living which are the major goals of introducing any improved practices in onion production.

The study has revealed that adoption of ROPPs had increased the income of the respondents by #189, 894.80 per farmer across the four villages in the study area and consequently has a positive effect on the respondent's level of living. The implication of this finding is that, if the respondents appropriately adopt the ROPPs would likely have

more money to take care of their family needs, which is an indication of family improvement in their level of living.

Onion farmers encountered inadequate storage facilities, inadequate capital and high cost of labour as the three major problems faced by the respondents. This suggests the onion farmer's inability to expand their current level of onion production.

Due to poor storage conditions in terms of ventilation, majority of the onion producers were seem to market produce immediately after harvesting, various marketing intermediaries had certainly taken advantage of this situation. This had undoubtedly led to un remunerative prices offer for most onion producers. The implication of absence of credit facilities is that it compels the farmers to lend money from lenders and middlemen at exorbitant rates of interest which forced them to sell at a predetermined price to the traders.

Besides social obligations (marriage and other ceremonies) which usually occur after harvest season, were other reasons for early disposal of the products at lower price. This suggests that government should construct good stores, well ventilated and provide it based on the richness of the farmers to ensure all year round availability of onion in the study area that could be used to export to other regions where onion is not adequately produced. The NACB (Nigerian Agricultural Cooperative Bank) should provide loan to the onion farmers to boost their level of productivity in the study area.

5.3 Contributions to Knowledge

The work has contributed the following to the existing body of knowledge in agriculture, extension and onion production fields.

i. It has revealed that socio-economic variables, institutional factors and technological variables showed 75% of the variation in the adoption recommended onion production practices in the study area.

ii. It has been found that, the adoption of recommended onion production practices had certainly increased the yield and income of the farmers in the study area. The farmers were able to take care of their family needs, which is an indication of an improvement in their level of living.

iii. The study has been to identified the major constraints encountered by onion farmers in the area which included inadequate extension services, inadequate storage facilities, inadequate credits and higher cost of labour.

5.4 Recommendations

Based on the findings of the study, the following recommendations are proffered to enhance the adoption of recommended onion production practices and onion production in the study area:

i. It was found that education was an important factor in the adoption of recommended onion production practices (ROPPs) and majority of the farmers were not literate. It is therefore, recommended that adult education and mass literacy campaigns should be organized by the State ADPs so that the dissemination of information especially printed materials on any recommended practices could be easily done. In addition, Research Institutes and State ADPs should organize pre-season trainings to farmers in the local language.

ii. It was found that membership of social organizations to be significant factor in adoption of ROPPs. Therefore, it is recommended that farmers should be

encouraged by the ADPs, NGOs, and INGOs to form co-operative groups for them to have access to farm inputs, to boost their level of productivity, income and living.

iii. It was found that many onion farmers had no access to credit. Therefore Agricultural Banks like Farmers Bank now Bank of Agriculture (BOA) should provide loan to the farmers with low interest rate and at a right time to ensure high economic return.

iv. There were limited extension services in the study area. It is therefore recommended that more extension agents should be recruited to improve extension services in terms of coverage in the study area.

v. It was found that majority of the onion farmers have no access to storage facilities. Therefore, government should build or construct good storage facilities that are well ventilated in order to ensure all year round supply of onion and with high economic value.

vi. The study shows that the yield obtained from this study was higher than farmers' practices. Therefore, it is recommended that farmers should adopt more components of the ROPPs for higher yield and income from onion production.

5.5 Suggestions for Further Studies

This study has attempted to provide some base line information (data) on some of the factors that influence adoption of recommended onion production practices in the study

area. However, it is desirable and therefore suggested that the following areas be probed for further research.

i. Comparative studies should be conducted to find out the difference in yields between the recommended onion production practices and traditional practices in the study area.
ii. It is suggested that future study should consider income of the onion farmers before and after adoption of recommended production practices in the study area.

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QUESTIONNAIRE FOR ONION FARMERS

Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria

Dear Sir/Madam,

I am a postgraduate student of Ahmadu Bello University, Zaria, currently working on the following topic: **"Factors Influencing Adoption of Recommended Onion Production Practices in Goronyo Local Government Area of Sokoto State, Nigeria".**

Please answer the questions to the best of your knowledge, all information supplied will be treated with confidentiality.

Thank you.

UMAR ABDULLAHI TAMBUWAL

SECTION A: Background Information

1. Name of respondent:……
2. Name of village:……...
3. Name of L.G.A:……

Section B: Socio-economic Characteristics of Onion Production Farmers in the Study Area.

4. Age:……years
5. Sex: Male ( ), Female ( )
6. Marital Status: Married ( ) Single ( )
   Indicate your household size:
7. How many wives do you have?.....
8. How many children do you have?.....
9. Beside your wife/wives and children, are there some people living with you?
   Yes ( ) No ( )
10. If yes, how many of them?.....

11. Educational Qualification of Head of Household:
    a. No formal education ( )
    b. Adult education ( )
    c. Koranic education ( )
    d. Primary education:……..years
    e. Secondary education:……..years
    f. Tertiary education:……..years
12. How long have you been in onion farming?.....years.

13. Do you belong to any social organization? Yes ( ) No ( )
14. If Yes, how many social organizations do you now belong to?.....
15. If yes, for how long have you been?.....years.
16. Did you have any visit by extension agents in 2012? Yes ( ) No ( )
17. If yes, how many times were you visited by the extension agents with information on onion production during the 2012 farming seasons?.....Times.
18. Are you satisfied with the visit? Yes ( ) No ( )
19. If yes, give reasons.

    ……

    ……

    ……

20. If no, give reasons.

    ……

    ……

    ……

21. Do you have access to credit for onion production? Yes ( ) No ( )
22. If Yes, state sources and amount of credit received in 2012 for onion production

S/No	Sources	Amount ₦

23. If No, how do you finance your onion farm?

    ……

    ……

    ……

24. Did you return the credit after harvesting your onion? Yes ( ) No ( )
25. If No, please give reasons for not returning the credit.

    ……

    ……

    ……

    ……

Section C: Awareness and Rate of Adoption of Recommended Onion Production Practices.

26. Which of these recommended onion production practices have you adopted on large-scale (2/3) and on a continuous basis? As introduced by Sokoto State ADP 2000.

		Are you aware of this practice?		**Do you use it?**		**If Yes, indicate the year of first use**
S/No	**Recommended Onion Production Practice**	**Yes**	**No**	**Yes**	**No**	
i.	Improved onion varieties					
ii.	Spacing 15 x 20 cm, 15 x 15 to 20 x 20cm					
iii.	Planting method by seed or sets					
iv.	Weed management					
v.	Transplanting mid-June, Nov/Dec					
vi.	Fertilizer application: 20-25 ton/ha of Farm Yard Manure (FYM) or 300kg/ha NPK 15-15-15 The first fertilizer application should be at land preparation and the remainder at 3-4 WAT.					
vii.	Disease control: Use of toxiphan, malathion, heptachlor, dieldrin, parathion.					
viii.	Harvesting : (onions are hand pull and kept in a shelter, bulbs are left in the shelter to cure for two weeks)					
ix.	Storage: (mechanical cold storage (refrigerated)					

27. State reasons for using the recommended onion production practices you have indicated above:

    a. ……..

    b. ……..

    c. ……..

28. State reasons for not using the recommended onion production practices you have indicated above:

    a. ……..

    b. ……..

    c. ……..

29. Do you wish to continue using the listed recommended onion production practices you have indicated above? Yes ( ) No ( )

30. If Yes, give reasons……
……
……

31. If No, give reasons…….
……
……

SECTION D: Adoption Intensity of Recommended Onion Production Practices

32. Which of these recommended onion production practices have you adopted on large-scale (2/3) and on a continuous basis? As introduced by Sokoto State ADP 2000.

S/No	Recommended Onion Production Practices	Total land under onion production	Total land of onion under recommended practices
i.	Improved onion varieties		
ii.	Spacing 15 x 20 cm, 15 x 15 to 20 x 20cm		
iii.	Planting method by seed or sets		
iv.	Weed management		
v.	Transplanting mid-June, Nov/Dec		
vi.	Fertilizer application: 20-25 ton/ha of Farm Yard Manure (FYM) or 300kg/ha NPK 15-15-15 The first fertilizer application should be at land preparation and the remainder at 3-4 WAT.		
vii.	Disease control: Use of toxiphan, malathion, heptachlor, dieldrin, parathion.		
viii.	Harvesting : (onions are hand pull and kept in a shelter, bulbs are left in the shelter to cure for two weeks)		
ix.	Storage: (mechanical cold storage (refrigerated)		

Section E: Output and Cost of Production of Onion by the Farmer

33.How many hectares did you use for farming purpose in 2012?.....ha

34. What size of your farms did you use for onion production in 2012 growing seasons?.....ha

35. What was the estimated quantity of onion you harvested in 2012 growing season?.....(130kg)?

36. Did you have available labour for onion production activities in 2012? Yes ( ) No ( )

37. Did you use hired labour for onion production activities in 2012? Yes ( ) No ( )

38. If Yes, how many people did you use for the following operations?

Operations for onion production	**Male: 18yrs and above**	**Female: 18 yrs and above**	**Male: 12-17yrs**	**Female:12-17yrs**
Land clearing				
Ridging				
Planting				
Weeding				
Fertilizer application				
Spraying of insecticides				
Harvesting				
Total				

39. Did you use family labour for onion production in 2012? Yes ( ) No ( )

40. If yes, how many people from your family did you use for the following onion production operations in 2012?

Operations for onion production	**Male: 18yrs and above**	**Female: 18 yrs and above**	**Male: 12-17yrs**	**Female:12-17yrs**
Land clearing				
Ridging				
Planting				
Weeding				

Fertilizer application				
Spraying of insecticides				
Harvesting				
Total				

41. How much did you pay/5hrs (man-day) in 2012 for the following categories of people?
    a. Male: 18 years and above……..₦
    b. Female: 18 years and above……..₦
    c. Male: 12 – 17 years ……..₦
    d. Female: 12 – 17 years……₦
42. What was the price in Naira per 130kg bag of onion in 2012 growing seasons?.....₦
43. From the following, indicate the ones you acquired/did with the money from 2012 onion production?

S/No	Item	Quantity	Current market value if to be sold ₦	Total value ₦
i.	Buses			
ii.	Pick ups			
iii.	Motor cycles			
iv.	Bicycles			
v.	Donkeys			
vi.	Horses			
vii.	Cattles			
viii.	Sheep			
ix.	Goats			
x.	Ox-plough			
xi.	Hand plough			
xii.	Others (specify)…….. ……. …….			

44. Is there any difference in your output as a result of adoption of recommended onion production practices? Yes ( ) No ( )
45. If yes, how? Decrease ( ) Increase ( )

46. If increase, how did the increase onion output affect your income? Please tick (✓) as applicable to you.

a. Very high ( ) b. High ( ) c. Average ( ) d. Low ( ) e. Very low ( )

47. How has the increase in onion output affect your standard of living?

a. Very high ( ) b. High ( ) c. Average ( ) d. Low ( ) e. Very low ( )

Section F: Constraints to the Adoption of Recommended Onion Production Practices

From questions 48-50, please tick from the following list using:
Very Expensive = 4
Expensive = 3
Cheap = 2
Very Cheap = 1
The following Recommended Onion Production Practices (ROPP) are expensive to use (practice effectively)

S/No	Recommended Onion Production Practices	VE	E	C	VC
x.	Improved onion varieties				
xi.	Spacing 15 x 20 cm, 15 x 15 to 20 x 20cm				
xii.	Planting method by seed or sets				
xiii.	Weed management				
xiv.	Transplanting mid-June, Nov/Dec				
xv.	Fertilizer application: 20-25 ton/ha of Farm Yard Manure (FYM) or 300kg/ha NPK 15-15-15 The first fertilizer application should be at land preparation and the remainder at 3-4 WAT.				
xvi.	Disease control: Use of toxiphan, malathion, heptachlor, dieldrin, parathion.				
xvii.	Harvesting : (onions are hand pull and kept in a shelter, bulbs are left in the shelter to cure for two weeks)				
xviii.	Storage: (mechanical cold storage (refrigerated)				

48. The following Recommended Onion Production Practices (ROPP) meets my need and existing values (Compatibility)

S/No	Recommended Onion Production Practices	SD	D	UD	A	SA
i.	Improved onion varieties					
ii.	Spacing 15 x 20 cm, 15 x 15 to 20 x 20cm					
iii.	Planting method by seed or sets					
iv.	Weed management					
v.	Transplanting mid-June, Nov/Dec					
vi.	Fertilizer application: 20-25 ton/ha of Farm Yard Manure (FYM) or 300kg/ha NPK 15-15-15					

	The first fertilizer application should be at land preparation and the remainder at 3-4 WAT.					
vii.	Disease control: Use of toxiphan, malathion, heptachlor, dieldrin, parathion.					
viii.	Harvesting : (onions are hand pull and kept in a shelter, bulbs are left in the shelter to cure for two weeks)					
ix.	Storage: (mechanical cold storage (refrigerated)					

49. The following Recommended Onion Production Practices (ROPP) is difficult to use: (Complexity)

S/No	Recommended Onion Production Practices	A	UD	D
i.	Improved onion varieties			
ii.	Spacing 15 x 20 cm, 15 x 15 to 20 x 20cm			
iii.	Planting method by seed or sets			
iv.	Weed management			
v.	Transplanting mid-June, Nov/Dec			
vi.	Fertilizer application: 20-25 ton/ha of Farm Yard Manure (FYM) or 300kg/ha NPK 15-15-15 The first fertilizer application should be at land preparation and the remainder at 3-4 WAT.			
vii.	Disease control: Use of toxiphan, malathion, heptachlor, dieldrin, parathion.			
viii.	Harvesting : (onions are hand pull and kept in a shelter, bulbs are left in the shelter to cure for two weeks)			
ix.	Storage: (mechanical cold storage (refrigerated)			

50. Apart from the above, what other problems are you facing in the adoption of recommended onion production practices in your area?

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51. What suggestions will you give that will help to accelerate the process of using ROPP in this area?

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Thank you very much.