TECHNOLOGY AND EXTENSION GAPS AMONG RICE FARMERS IN OGUN STATE, NIGERIA

OLADELE O.I, ABISOYE B. SOMORIN

Abstract

This study determined the degree of technology and extension gaps among rice farmers in Ogun State. Two out of the four zones (Abeokuta and Ikenne), where rice production is prevalent were selected. From the two zones with a total of 1 050 farmers, 100 farmers were randomly selected. Also 50 extension agents were randomly selected. A combination of both primary and secondary data were used and subjected to frequency counts and percentages. The result shows that majority of the farmers (58%) are male and are above 40 years of age (43.4%) married (60%), Christians (62.5%) and without formal education (54%). Majority of the respondents (66%) has family size of between 5–10 members. The extension gap shows that the degree of deviation from the expected yield was so prominent with the category of 0.5 to 1 t/ha representing 68 percent of the farmers. The most critical proportion are those whose yield are lower than the expected yield by more than 1t/ha (10 percent). The technology gap, shows that the differential was mainly less than 0.5t/ha (70 percent). However, about 10 percent had a yield difference. Farmers were more knowledgeable in the areas of when fertilizer should be applied (69.3%), period of 2nd weeding after planting (72%), period of application of Pre-emergence herbicides (69.3%) and the number of times weeding should be carried out on the rice farm (66.7%). Farmers were accurate when mixing herbicides and water (94.7%), period of applying post emergence herbicides (72%), and period of first weeding on the rice farm (69.3%).

Key words: technology transfer, technology gaps, extension gaps, rice farmers, Nigeria, on-farm adaptive research, expected yield, actual yield

INTRODUCTION

In West Africa, the food sub-sector parades a large array of staple crops which is made possible by the wealth of agro-ecological diversity. These food commodities are of considerable importance for food security, expenditure and income of households. According to Imolehin and Wada (2004), rice is the most important food crop for about half of the human race and has traditionally been an important basic food commodity for certain populations in Sub-Saharan Africa and West Africa in particular. It has risen to a position of pre-eminence and enjoying a rapid growth in per-capital consumption in the sub-region. The regional demand of rice has grown at an annual rate of 6% driven by a combination of population growth and substitution away from traditional coarse grains such as sorghum and millet.

The importance of rice in Nigeria is no longer the question but rather how to meet the growing demand, reduce import and be self-sufficient. Consumption per capita jumped from 2.9 kg in 1970/74 to 25 kg in 2004 (Rice web, 2001). Production figure increased 6 times within the period to 3.27 million tons for importation figure reaching a climax in 1998 at 1 million tons which accounted for one-third of the total import for West Africa. The important features that have been driving the promotion of rice production and dissemination in Africa according to Azuma (2004) include the fact that rice is the most productive grain in a unit of arable land in Africa, can be grown three times a year in most of African countries, and easy to be allocated in crop rotation properly. The poorest third of urban households obtain 33% of their cereal-based calories from rice, and rice purchases represent a major component of cash expenditure on cereals (World Bank, 1995).

Presently, rice is cultivated in virtually all, the agro-ecological zones in Nigeria, and there is increasing area cultivated to rice by resource-constrained farmers in terms of area cultivated and technology utilized. As a result, rice research has as its objective to increase production capabilities per unit area, through breeding and selection. Appropriate use of these improved and, in most cases, ecology-specific rice varieties by farmers in the different ecologies will boost overall national rice production (Imolehin, 2004). In view of this, the West African countries established the West African Rice Development Association in 1971 with the support of international organizations with the initial strategy of the adaptation of technologies developed in Asia that were instrumental in the achievement of food security in those densely populated countries. The focus was on validation of available rice technologies and training. The improvement of rice yield is viewed as an instrument for improving food security and alleviating poverty, while preserving the natural resources in West Africa.

In Nigeria active systematic research in rice started in 1953 with the establishment of federal rice station at Badegi in Niger State. The focus then was the development of rice varieties with improved grain quality, uniform shape and sizes appropriate for minimal breakage during milling. Between 1954 and 1970, 13 improved varieties, comprising 2 upland, 8 shallow swamps and 3 deep flooded rice were released. From 1971, research activities focused on developing high yielding and disease resistant varieties, efficient use of nutrients and

good soil management which were achieved through introduction, adaptation and release of the new varieties. Despite the research findings, rice yield in the field is yet to catch up with the expect yield which has led to the burgeoning concern of gross yield differential of already adapted rice varieties and the discontinuance of same by farmers. Narrowing yield gaps plus increasing rice yield and production, will improve land and labour use efficiency. Also, it will lead to reduced production cost and increased sustainability. As opined by FAO (2004), reducing the yield gap alone could supply 60 percent of the increased annual rice demand by the year 2005. FAO (2000) reported that the causes of yield gaps can be classified according to their nature and the degree to which they contribute to the gaps. These include Biophysical factors such as climate/weather, soils, water, pest pressure, weeds and Technical/management factors which comprises of tillage, variety/seed selection, water, nutrients, weeds, pests, and post-harvest management. Others are socio-economic factors (socio-economic status, farmer's traditions and knowledge, family size, household income/expenses/investment) and Institutional/policy factors in terms of government policy, rice prices, credit, input supply, land tenure, market, research, development, extension; as well as Technology transfer and linkages factors that consist of the competence and facilities of extension staff; integration among research, development and extension; farmers' resistance to new technology; knowledge and skills; weak linkages among public, private and non-governmental extension staffs.

Gomez et al., 1979 identified two types of yield gaps between experiment station and farmers' fields, depicted as Gap 1 and 2. Gap 1 is attributed to environmental differences and referred to as "non-transferable technology" while Gap 2, is the difference between potential and actual farmer yields, which constitutes the true research-extension gap due to combinations of biological, technical, and socioeconomic constraints. Evenson (1997) described three types of yield gaps namely extension gap- the difference between best practice (BP) and average (A) yields; the research gap is the difference between research potential (RP) yields and best practice (BP) yields and science gap exists between science potential (SP) and research potential (RP) yields. Lin and Shen (1995) reported two kinds of yield gaps. Yield gap I is the difference between the maximum yield obtained on an experiment station and the potential average yield that may be achieved under favorable farm conditions in a region while Yield gap 11 is the difference between average farm yields and yields attainable under favorable conditions for all farm-controlled varieties. All the authors generally reported that Extension and applied research programmes are designed to reduce the different types of yield gaps.

The transformation expected through agricultural research is actually dependent on the effectiveness of agricultural extension service, such that explanations are provided on why research findings are utilized, discontinued, rejected, abandoned or continuously used. Extension programmes are designed to reduce both practice gap and institution gap while research programmes are designed to reduce research gap or the technology gap.

According to Evenson (1997) and Oladele (2004), an effective agricultural extension can bridge the gap between discoveries in the research laboratories and farmers field. An understanding of the size and causes of yield gaps is fundamental in focusing research and in formulating appropriate technologies and recommendations for various categories of farmers. For the Federal Government initiative on Rice to be a realistic effort, a necessary move in achieving some of the Millennium Development Goals (MDGs), an assessment of the technology and extension gap among rice farmers is necessary. Knowledge of the size and types of yield gaps will be useful in advising rice farmers and will provide the necessary take-off platform for appropriate policy formulation. The objective of this study was to determine the degree of technology and extension gaps among rice farmers in ogun state Nigeria.

MATERIALS AND METHODS

The study was carried out in Ogun State because it is one of the leading rice producers in Southwestern Nigeria (PCU, FMARD, 2001). Ogun state has a total land area of 17 084.3 km^2 extending between latitudes $6^0$30' and $7^0$5' N and longitudes $2^0$80' and $4^0$60' E with annual rainfall ranging from 1 000 mm to 2 000 mm. The state has a bimodal rainfall pattern that allows two cropping seasons for most annual arable crops especially when the rainfall extends beyond August. The state is bounded in the west by the Republic of Benin; in the south by Lagos state and the Atlantic Ocean; in the east by Ondo State and the north, by Oyo and Osun state. The state is predominantly agrarian and the agro-ecological division of the state was made by Agricultural Development Programme (ADP) such that the state comprises of four zones – Abeokuta, Ijebu, Ikenne and Ilaro.

The population of the study was all Extension Agents (EA) and rice farmers in Ogun state. From the four (4) ADP zones, two (Abeokuta & Ikenne), were selected due to high concentration of rice production. In these selected zones, there are 10 blocks and 24 circles with a total of 1 050 farmers. One hundred farmers were randomly selected for the study. Similarly from a list of 122 village extension agents of the Agricultural Development Programme, 50 were randomly selected.

Interview schedule based on a structured questionnaire were conducted during the 2006 growing season to collect data on farmers' knowledge of rice production practices, their accuracy of implementation production technologies and socio-economic characteristics, while secondary data were obtained from the records of Agri-

cultural Development Programme on On-Farm-Adaptive-Research and Small Plot Adoption Technique yield.

The variables of the study Technology gap was determined as the difference between the On-Farm-Adaptive Research yield and Small Plot Adoption Technique yields while extension gap is the difference of the Small Plot Adoption Technique yield and actual farmers' yield (Gomez et al., 1979; Thakral and Bhatnagar, 2002). Other variables are knowledge of rice production practices, accuracy of implementation of the practices and the socio-economic characteristics of the rice farmers. The knowledge of production practices was operationalized using a two-point scale of Yes and No indicating 1 and 0 respectively. The accuracy of implementation of practice was measured using a two-point scale of Accurate (A) and Not Accurate (NA) indicating 1 and 0 respectively.

RESULTS AND DISCUSSION

As shown in Table 1, majority of the farmers (58%) are male and are above 40 years of age (43%) married (60%), Christians (63%) and without formal education (54%). Majority of the respondents (66%) has family size of between 5–10 members. This shows that large family is still a prestige among farmers as they often depend on family labour.

Table 2 presents the results of the knowledge test among rice farmers and shows that farmers are more knowledgeable in the areas of when fertilizer should be applied (69%), period of second weeding after planting (72%), period of applying pre-emergence herbicides (69%) and the number of times weeding should be done on the rice farm (67%). How ever the results shows that farmers have low knowledge in the areas of seed viability in order to achieve the desired plant population

Tab. 1: Description of respondents' demographic characteristics

Demographic characteristics	Description
Age	58 percent are above 40 years
Gender	About 76 percent males
Marital status	60 percent married
Religion	About 63 percent Christians
Education	About 54 percent without formal education
Household size	66 percent have 5 -10 members

Tab. 2: Percentage distribution of rice farmers based on knowledge of rice operations (%)

OPERATION	True	False
A good viable rice seed is essential to achieve good plant population	36	64
Good viable seed can be sourced through the ADPs	44	56
A good clay-loam soil is necessary for rice production	46	55
Land preparation and clearing start by Jan.– Feb.	64	36
In flooded lowland, land preparation starts by July	66	35
In flooded lowland, nursery establishment is essential	40	60
The soil for rice production must have good water retention	56	44
Water should be made available during the early days of rice	56	44
Fertilizer, when applied increases yield, prevent disease and gives good tillering	60	40
Fertilizer could be applied through broadcasting and split application	61	39
Fertilizer should be applied before rice is planted	31	69
Fertilizer should be applied after weeding	55	45
Broadcasting of fertilizer should be avoided when the leaves are wet	69	31
Organic manure could be used on rice farm	59	41
Sedges, broadleaves and grasses are common weeds on rice farm	61	39
Weeding operation can be through slashing, uprooting or herbicides	64	36
Weeds can be prevented on rice farm through ploughing, use of clean seed, use of rice with good tillering ability	67	33
Use of recommended spacing will prevent weed infestation	61	39
Weeding should be done 2–3 times before harvesting	67	33
1st weeding is done 2–3 weeks after planting	72	28
2nd weeding should be between 5–6 weeks after planting	72	28
Herbicides should be applied to rice farm pre and post emergence	61	39
Pre-emergence herbicides should be applied between 1st and 2nd day of planting	69	30
Post-emergence herbicides should be applied between 14th and 21st day of planting	61	39
If pre-emergence is applied; the seed will sprout between 30–45 days after planting	61	39
Spraying should be done when it is windy	57	43
The mixing ratio is 150 ml herbicides with 20 litres of water	56	44

(36%), sources of viable seeds (44%) and soil type required for rice production (45%). The knowledge score has also shown areas of training needs of rice farmers.

From Table 3, the degree of accuracy of implementation of rice cultivation practices shows that farmers are accurate when mixing herbicides with water (95%) and determining the time of applying post-emergence herbicides (72%), and the period of first weeding on the farm (69%). The degree of inaccuracy was however higher for practices such the use of viable seeds (36%), determination of soil type and texture (44%), the period of land preparation (36%) periods of fertilizer application (39%) and the number of times weeding is carried out (39%). The trend of the results may be due to the fact that farmers practice rain-fed agriculture and timeliness and availability of inputs may not encourage the accuracy of practices.

Table 4 gives the results of the differential in the yield gap experienced by rice farmers and extension agents. The extension gap which is was determined by subtracting actual farmers yield from the SPAT yield shows that the degree of deviation from the expected yield was so prominent with the category of 0.5 to 1 t/ha representing 68 percent of the farmers. The most critical proportion are those whose yield are lower that the expected yield by more than 1 t/ha (10 percent). The result may be attributable to different factors with different degrees of severity contributing to the yield gap experienced by rice farmers in the study area.

In terms of the technology gap, the differences in the OFAR yield and SPAT yield shows that the differential was mainly less than 0.5 t/ha (70 percent), this may be attributed to the fact that OFAR and SPAT are managed by subject matter specialists and that the size of the adaptive researches are not large enough to simulate resource constraints that may be experienced by farmers cultivating larger areas. However, about 10 percent had a yield differential of above 1 t/ha. The timeliness of operations and vagaries of weather may be responsible for this.

Tab. 3: Percentage distribution of rice farmers based on accuracy of implementation of rice operations (%)

Operations	Accurate	Not Accurate
I ensure the use of good viable seeds for planting	64	36
My rice farm has a well textured clay-loam soil for planting	56	44
The clearing/land preparation starts by Jan.– Feb. for the season	64	36
In flooded lowland, I start land preparation by June-July for the season	72	28
I ensure nursery establishment in flooded lowland area	68	32
I maintain good water level at the early emergence stage	67	33
Fertilizer application is done strictly before planting	61	39
Fertilizer application is carried out after weeding	61	39
Weeding operation is done 2–3 times before harvest	61	39
I ensure the use of the recommended spacing for rice	67	33
The first weeding is done by the 2–3rd week after planting	69	31
Post emergence herbicides is applied between the 14–21st day of planting	72	28
The farm is sprayed when it is windy	61	39
I ensure to mix the herbicides at 150 ml/20 litres of water	95	5

Tab. 4: Percentage distribution of technology and extension gap among rice farmers planting ITA 150 variety

Yield gap categories t/ha	Extension gap (FP)*	Technology gap (FP)*
Less than 0.5	22 (22)	35 (70)
0.5–1	68 (68)	10 (20)
Above 1	10 (10)	5 (10)
Total	100 (100)	50 (100)

*FP = Frequency, Percentages

CONCLUSION

The study has clearly shown that technology and extension gaps exist among rice farmers in the study area. This has further expatiate the issue of yield gap analysis as related to rice yield. The differentials in yield as technology is being transferred is a prove of many institutional and services needs to be met in order to reduce yield gap and enhance productivity. The transformation expected through agricultural research is actually dependent on the effectiveness of agricultural extension service, such that explanations are provided on why research findings are utilized, discontinued, rejected, abandoned or continuously used. Extension programmes are designed to reduce both practice gap and institution gap while research programmes are designed to reduce research gap or the technology gap. Extension gap shows that the degree of deviation from the expected yield was so prominent with about 68 percent of the farmers while the technology gap shows about 70 percent had less than 0.5 t/ha.

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Received for publication on July 14, 2008
Accepted for publication on October 16, 2008

Corresponding author:

Oladele O.I.
Department of Agricultural Economic
Education and Extension, Botswana College of Agriculture
University of Botswana, Gaborone
Botswana
e-mail: oioladele@bca.bw, oladele20002001@yahoo.com