Importance of Pesticides for Growing Rice in Sub-Saharan Africa
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Rice is the most rapidly growing food commodity in Sub-Saharan Africa. Traditionally, rice was grown as a subsistence crop by smallholders and largely consumed on the farm. In recent years, demand from urban consumers for rice as a storable and easily prepared food has increased tremendously. Greater use of pesticides on farms in Sub-Saharan Africa has great potential for increasing rice production.

INTRODUCTION

In Sub-Saharan Africa (SSA) total rice consumption over the period 2000-2012 increased from 12MT to 24MT. African rice production has not been able to keep up with demand and nearly 37% of the rice consumed in SSA is imported at a cost of US$5 billion per year draining foreign currency reserves. This reliance on food imports is a very risky, expensive and unsustainable strategy and it may lead to severe food insecurity and civil instability. The risks became clear in 2008 during food riots in major African capitals in protest against high rice prices caused by rice-exporting countries banning exports. Many African countries have embarked on ambitious programs to boost their rice production capacity.

A recent assessment by AfricaRice concluded that the highest impact in benefitting rice production in SSA would be provided by research addressing weed infestations followed by research addressing rice diseases. Research on insect control ranked 6th among the research priorities, following research on soils (fertility), birds and rodents, and climate-related constraints (drought).

FUNGICIDES

Farmers in SSA perceive rice diseases to be of high importance with 21% identifying rice blast as a major constraint on production. Blast spores are present year-round and can infect the rice plant at any growth stage. Foliar lesions reduce the leaf area available for photosynthesis. Blast stops nutrients and water from getting to the kernels, stopping kernel development. Portions of the grain head are white in contrast to the green or tan color of healthy grain. This “blasted” appearance is caused by sterile or blank grain. In SSA, a blast disease outbreak can cause the loss of about 35-50% of rice yield, and in serious outbreaks, 100% rice yield losses have been recorded. Rice farmers have abandoned some inland valleys in SSA because of high blast pressure. Recent increases in rice blast epidemics in SSA are associated with changes in climate and with increased use of fertilizers. In demonstration plots, the incidence of blast in plots without fertilizer was one-seventh to one-half of that in plots that received fertilizer. Thus, blast constitutes a serious constraint to intensification as a great part of the benefit due to fertilizer application is lost by the increase of the damage due to the disease.

Evaluations of fungicides in SSA for control of rice blast have been ongoing since the 1970s. The research has shown that under high blast pressure, application of fungicides at the right time results in significant yield increases. Recent research in a blast-conducive environment in Burkina Faso resulted in rice yield increases of 44-124% following the application of a single fungicide treatment. The AfricaRice Center in a Production Handbook for Nigeria recommends fungicide applications.
sprays on rice in areas conducive to fungal diseases. In Kenya, these fungicides are readily available in the market. In 2009, when Kenya was highly affected by blast, the government provided some of these fungicides to farmers for free.

INSECTICIDES

Insect pests substantially reduce rice yields in SSA. The estimates of rice yield loss due to insects in Africa range between 10% and 15%. The damage differs regionally by country and rice variety and in some years may exceed 90%. African rice farmers identify the African rice gall midge as a major problem on 30% of their farms while stem borers are a major problem on 19% of the farms. Tunneling of stem borer larvae severs tillers thus reducing their number through the formation of “deadhearts.” Damaged shoots do not produce a panicle and thus produce no grain. Feeding of stem borers during the reproductive stage causes a severing of the developing panicle at its base. As a result, the panicle is unfilled and whitish in color; rather than filled with grain and is known as “whitehead.” A single insecticide spray based on thresholds of deadhearts or whiteheads resulted in yield increases of 10-18% and a cost benefit ratio of 1:17.4.

The African rice gall midge has become more common since the 1970s with outbreaks associated with rice-rice double cropping and increases in fertilizer applications. The African rice gall midge looks like a mosquito. Fertilized females can lay up to 300 eggs. When the eggs hatch, the larvae migrate to the plant’s growing point, where they feed while secreting a substance that inhibits the formation of panicles. Affected tillers do not produce a single grain of rice. Heavily infested fields may produce no grain at all. Studies over a five year period with insecticides revealed that controlling the African rice gall midge prevented yield losses of 19, 17, 11, 11, and 3%.

HERBICIDES

According to surveys, African farmers see weeds as the most serious problem in rice production with 70% of farmers identifying weeds as a major constraint. (Every single rice farmer identified weeds as a problem). When weeds are not controlled, rice yield losses up to 100% occur. Many rice fields have been abandoned due to heavy weed infestation.

Hand weeding is the traditional method of weed control on rice farms in SSA; this is labor demanding and requires about 125-172 hours/hectare per weeding. Two weedicings by hand within 14-40 days after planting have been recommended. Weeding is frequently inadequate or delayed, often due to labor shortages or conflicts for time between on- and off-farm activities. Farmers usually weed the rice crop at least once, though this is often delayed. Research has shown that yields from farmer-weeded plots were significantly less (41%) than researcher-weeded plots.

In a survey of rice farmers in Cote d’Ivoire, 53% of farmers reported that their rice fields were not always weeded. A reason given for this by almost two-thirds of the farmers was that weed infestation may be so severe that weeding was not always worthwhile, therefore the field would be effectively abandoned. Almost 80% of farmers said that if weeds were less of a problem, they would increase the area of land under rice cultivation. Uncontrolled weeds in SSA rice fields account for yield losses estimated at 2.2 million tons per year.
Research with recommended herbicides in comparison to farmer weed control practices in Senegal and Mauritania resulted in rice yield increase of 0.9-1.0 t/ha. The value of the increased production was 4.4 times the cost of the herbicide treatments. With herbicide applications, the cost of weed control in rice can be about 50% lower than with hand or hoe weeding. Herbicide use reduces weeding time by 88-97% in comparison to hand weeding. Since farming in Africa is essentially limited by the availability of labor, rather than the availability of land, any reduction in the labor required for weeding would free farmers to expand their cultivation and therefore grow more rice.

Weed scientists and botanists at CIRAD and AfricaRice developed an interactive on-line weed identification tool (AFROweeds) to assist in weed management in rice. WARDA and IFDC developed a curriculum for Integrated Rice Management in inland valleys of SSA consisting of a technical manual and a facilitator’s guide including a module on the use of herbicides. The AfricaRice Center in a Production Handbook for Nigeria includes herbicide recommendations.

**CONCLUSIONS**

The use of herbicides and insecticides by rice farmers varies systematically across SSA. Use is highest among large-scale private and public farmers and farmers who are members of farmers’ associations and among farmers who grow rice in rotation with cotton. A recent survey of irrigated rice farms in Benin revealed that herbicides were used on none of the acres in one region and 33-100% of the acres in five regions. Insecticides were used on none of the rice acres in two regions and 83-100% of the acres in four regions. A survey of 13 rice-growing regions in Nigeria revealed no use of herbicides. Fungicide application is almost non-existent in the rice fields of the SSA.

Lack of knowledge among rice farmers on how to use pesticides effectively is a major impediment in raising rice production. Poor access to pesticides affects farmers’ ability to deal effectively with diseases, insects and weeds. Effective pesticide use requires farmers to know exactly how and when to apply. They need to use the appropriate product, application equipment and application rates and need to be taught to target the life-cycle stage that is susceptible to pesticide use. Although research has led to the development of

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**Box 1: Herbicide success in Ghana**

“For improving rice production in Ghana, the Ministry of Food and Agriculture (MOFA) has made six key recommendations including the use of herbicides for weed control. A 2012 survey in Ghana revealed high herbicide use with 84% of rice area treated. The yield of plots with herbicides is significantly higher than of plots without herbicides. For irrigated plots with fertilizer and certified seed, there was a 3.1 ton/ha difference between plots with and without herbicide. For lowland rain-fed areas, the difference was 1.4 tons/ha and for upland areas the difference was 2.2 tons/ha. Farmers using herbicides in Ghana save 55% in comparison to the cost of hand-weeding. The entry of inexpensive herbicides into Ghana has made it cheaper to purchase and use herbicides than to spend much time or hire labor for weeding. The diffusion of herbicides in Ghana is wide and farmers are learning about it from other farmers. Half of farmers report that they knew about herbicide use and its benefits from advice by or observing other farmers’ plots. 32% of farmers said they had received information about herbicides from MOFA, 18% received information on herbicide use from visits by agents or researchers and 11% from projects by donors or NGOs. The adoption of herbicides by rice farmers in Ghana suggests that if a technology is beneficial, it can spread rapidly among farmers.”

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**African women handweeding a rice field.**
pesticide use recommendations for rice farmers, the absence of effective information and technology dissemination programs has seen limited adoption. This lack of adoption is particularly glaring for fungicide use throughout SSA.

Rice has moved in importance from a subsistence crop to a profitable cash crop for farmers. The high profit margins obtained with the use of pesticides indicates that an increasing number of rice farmers will adopt this technology in the near future. In Ghana, recent high adoption of herbicides resulted from promotion by government, research, donor and NGO organizations. The governments of Togo and Sierra Leone have made a priority to test and spread information about herbicide use promoting a “massive” infusion of herbicides into rice farming.18, 19

REFERENCES