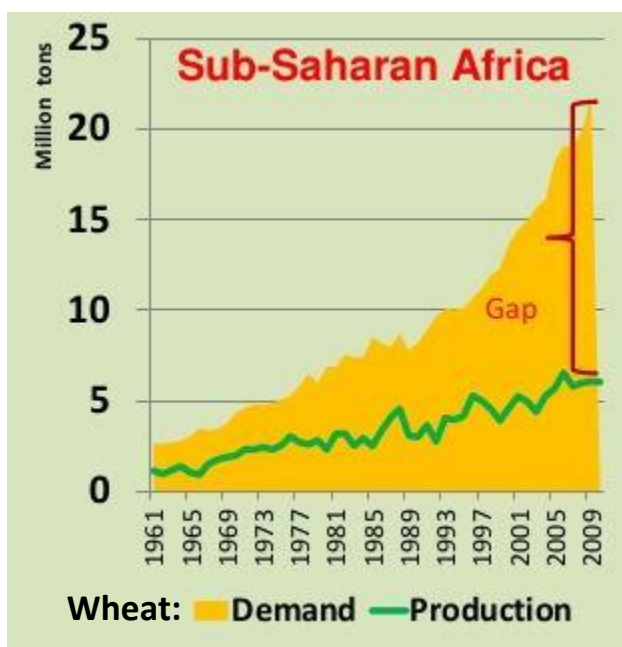


Importance of Pesticides for Growing Wheat in Sub-Saharan Africa

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INTRODUCTION

Per capita wheat consumption in Sub-Saharan Africa (SSA) has been growing over the past few decades reflecting a shift away from consumption of coarse cereals as a result of urbanization, rising incomes and dietary diversification.¹ Very little wheat is produced in SSA and thus there is a tremendous reliance on imports to meet consumption needs.² Imported wheat makes up about 70% of the wheat consumed in SSA at an annual import cost of US \$5 billion/year.¹ Africa accounts for about 24% of the global trade in wheat. It is essential for SSA countries to meet more of their domestic wheat needs through developing their own production capacity.² Reducing wheat yield losses due to insects, diseases and weeds would significantly increase wheat production in the SSA. Assuring the availability of wheat at affordable prices is of strategic policy importance for economic growth and to avert political instability.



Source: CIMMYT^{1,2}

HERBICIDES

In SSA, weeds are a major constraint on wheat production and significant crop losses occur due to weed infestations. Weed problems in wheat in SSA have worsened in recent years due to the increased adoption of small-statured high-yielding varieties that are less competitive with weeds and by the increased use of fertilizers. The use of fertilizers has led to increased weed growth since weeds usually absorb fertilizers faster and in relatively larger amounts than wheat.⁴ The traditional weed control method used by smallholder wheat farmers is hand-weeding by family members. Two hand-weedings are recommended. Estimates of the labor required to hand weed wheat range from 20 to 75 work days/ha.¹⁰ However, due to competing demands on family labor and the overlapping of the optimal times for weeding with other crop activities, there is a shortage of labor for hand-weeding at the optimal times.¹⁰ As a result, weeding is either not done at all or is performed inadequately. About 26% of smallholder wheat growers do no weeding.¹⁴ Research has shown that in wheat fields in SSA, uncontrolled mixtures of grass and broadleaf weeds reduce wheat yields by about 60%.⁴ When weeding is done, the typical wheat farm is weeded once. This weeding operation is typically late after the weeds have already reduced the crop yield potential.

Research on the use of herbicides for controlling weeds on wheat farms in SSA has been ongoing since the 1960s. Large-scale wheat farms use herbicides extensively and their use is seen as essential since hand-weeding the large farms is completely impractical.¹⁰ However, there is almost no use of herbicides by smallholder wheat farmers in the SSA.¹² Herbicides have not been promoted for smallholders and farmers have not been trained in their use. Some governments

(Ethiopia) have deliberately discouraged the promotion of herbicides to smallholders under the assumption that there is sufficient labor to do hand-weeding.⁹

Research with herbicides has shown that control of broadleaf and grass weeds result in 100-300% increase in wheat yields in comparison to the un-weeded plots and an increase in yield of 35-78 % in comparison to the current practice of hand-weeding one time.^{8,6} The use of post-emergence herbicides to control broadleaf and grass weeds provide wheat yields equivalent to the current recommendation of hand-weeding twice.⁵ The current recommendation of two hand-weedings is not acceptable to wheat farmers because of competing demands for labor.

Herbicidal weed control has been demonstrated to be highly profitable in the smallholder SSA wheat sector with the potential to increase wheat yields significantly. Availability and competitive price levels for herbicides as well as the availability of sprayers should be supported. Farmer understanding of the use of herbicides should be encouraged through on-farm demonstrations.⁷



Russian Wheat Aphid Damage

INSECTICIDES

Insecticide use on wheat in SSA occurs primarily in South Africa, Ethiopia and Kenya where populations of the Russian Wheat Aphid (RWA) are well established. The RWA appeared in 1978 in South Africa and caused yield losses up to 92%; in Ethiopia in 1988 RWA caused

losses up to 68% and first found in 1995, RWA caused losses up to 90% in Kenya.¹⁷

RWA feeds on the newest growth on the plant and effectively cause cessation of chlorophyll production in those leaves. Symptoms of RWA damage include reduced plant height, sterile heads, low kernel weight, and in the most severe conditions, death.¹⁷

Wheat cultivars resistant to RWA have been available to South African farmers since 1992. However, the continual appearance of new RWA biotypes means that resistant cultivars for controlling RWA populations may not be sustainable.¹⁵ New RWA biotypes affecting all the wheat cultivars on the market have been detected in parts of the eastern Free State of South Africa.¹⁵ All of the wheat varieties in Kenya are susceptible to RWA and resistant cultivars from South Africa have not demonstrated equivalent resistance in Kenya due to differences in RWA biotypes.¹⁷

Chemical control of the RWA is the only option for Kenyan wheat farmers. Chemical control can be achieved when systemic insecticides are applied to the seed at planting or when foliar systemic insecticides are applied. One spray is recommended. Systemic seed treatments increased yields by 123-175% over the untreated control.¹⁸ Similarly, foliar sprays of systemic insecticides resulted in yield increases of 17-22%.¹⁸ Wheat yield losses caused by RWA in Kenya are still high since most farmers use non-dressed seed or fail to use effective sprays due to their cost.¹⁸ In recent years in Kenya wheat yield losses of about 30% have occurred due to RWA.¹⁶

FUNGICIDES

Diseases caused by fungi are among the most important biotic factors constraining wheat production in SSA. Large-scale farmers have extensively used fungicides to control rusts. Yellow rust (or stripe rust), stem rust and *septoria* diseases are prevalent. Yield losses of 25-82% due to *septoria* have been recorded.¹⁹ Breeding for resistance to *septoria* has not been successful because

expression of resistance is correlated with negative traits such as tall plant height and late maturity.¹⁹ Research has shown that fungicide applications effectively control *septoria* in SSA.²⁰



Fungicide Treatment For Ug99 (Treated vs. Untreated)

Stem rust (SR) produces black pustules on wheat plants and can cause substantial yield losses (50-70%). A trillion SR spores can be produced from one acre of rusted wheat in 8 days. Infected grain is shriveled, light in weight, and of low quality. Stem rust was under control for several decades in Africa through widespread use of resistant cultivars. A new race of stem rust TTKS (Ug99) was detected in Uganda in 1998/99. Yield losses of up to 80% were reported. All the current commercial wheat cultivars are highly susceptible to the new race and it is not possible to grow a profitable crop of wheat without the application of a fungicide.³ Research in Kenya demonstrated that a number of fungicides can be used effectively in reducing rust severity and increasing the yield of wheat. Grain yield increases of 45-57% were obtained by applying fungicides to control Ug99.³ Ug99 is mutating and migrating rapidly. Seven variants are now recognized within the Ug99 lineage. Within east and southern Africa, members of the Ug99 lineage are now the predominant stem rust pathotype. Many small-scale farmers in eastern Africa have given up growing wheat

because of pressure from Ug99. African wheat farmers are being advised about how to properly use fungicides to control an outbreak.

CONCLUSIONS

Small scale farmers have minimal access to chemical inputs and hence achieve very low wheat yields. Despite the availability of wheat varieties with a yield potential of 6-7t/ha, the actual yield is about 1.5-2.5t/ha. The yield gap is largely due to biotic challenges from diseases and pests.¹¹ Wheat yields in SSA can be increased substantially with the increased use of herbicides, insecticides and fungicides. To have a sustainable impact on wheat production in SSA, increased fertilizer usage should be accompanied by the provision of herbicides.

There is great potential for profitable wheat in Sub Saharan Africa. Provision at the right time and place of pesticides of the right quality and quantity is critical for increasing the competitiveness and profitability of the wheat sector in SSA.²

Box 1: Fungicide Use: Ethiopia

Wheat stripe rust is the most important disease for bread wheat in Ethiopia. Rust control by fungicide application is one of the most popular means of maximizing grain yield globally. However, until recently farmers in Ethiopia did not use fungicides in wheat production due to lack of awareness about the yield advantage gained by fungicide application, availability and cost of fungicides. To quantify fungicide efficacy on yellow rust and demonstrate the yield advantage gained by fungicide applications to the farmers, about ten fungicides were evaluated. Farmers who applied fungicides saved an average grain yield of between .8 and 1.6t/ha, the zonal average being 1t/ha. Extrapolating to the 123,357ha of fungicide-treated wheat area, indicated that the total yield saved from rust was 123,357t. Rust management by fungicide application can be one of the important ways of contributing towards national food security".¹³

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