

AN OUTLINE FOR PRE-SCREENING IN WEED CONTROL

The pre-screening of components for an on-farm experimental program includes attention to three basic factors:

- A) Profitability. If a new component costs more than the farmer's practice, it will have to offer a sufficient yield increase to repay the investment. Another possibility is a component which maintains yields but reduces costs.
- B) Risk. Although a component may be profitable on average, farmers want to have some idea of the variability in results. If significant losses are a possibility, farmers may wish to pursue another alternative.
- C) System compatibility. In order for a component to be acceptable it must not only pass the tests of profitability and risk, it must also be compatible with the farming system. That is, it must be able to be accommodated by the practices and conditions associated with the farmer's management of other crops, animals, and off-farm enterprises.

These three factors form the basis of the following outline. For each factor, a brief discussion of the information necessary for a pre-screening is provided, and references are listed, where available.

There are many possible components to be considered when weed control is an opportunity for investigation. The following discussion is divided into four broad categories:

- I Chemical weed control
- II Timing or frequency of manual weed control
- III Intercrops, cover crops, mulching
- IV Equipment

I Chemical Weed Control

A. Profitability

1. Cost of Chemicals

A survey of herbicide costs and availability should be done before proposing components for experimentation. There are cases in which experimentation with products that are very costly or not available might be done, but these are directed more towards policy makers, and should be carried out only after careful consideration of the likelihood of a change in policy.

References:

2. Type of chemicals, dosage

It is necessary to estimate the dosages of each type of herbicide that will be necessary. This involves a study of the weed population.

References:

S.R. Winter, A.F. Wiese "Economic control of weeds in sugarbeets (*Beta vulgaris*)" *Weed Science* 30: 620-3 (1982)
Choice of herbicide vs hand labor depends on amount of weeds in field.

Work on chemical weed control in highland Ecuador by INIAP (PIP) where maize cycle was long enough to require extra applications of herbicide.

3. Availability of sprayers

If farmers do not presently use herbicides it is worthwhile asking about the availability and cost of sprayers. Even if

herbicides are used, the availability of sprayers bears investigation.

References:

Survey in Jutiapa, Honduras as part of CIMMYT ICT (Survey showed no differences in timing of 2,4-D application between sprayer owners and renters).

4. Availability of water

The availability of a source of clean water sometimes influences the choice of chemical weed control methods.

References:

5. Labor considerations

If chemical weed control is going to replace or modify hand methods of weed control then an examination of the labor market is necessary. If hired labor is inexpensive, or family labor has a low opportunity cost, then herbicides may not be a viable option. If, on the other hand, labor is scarce, then herbicides may be an important opportunity.

References:

I. Akobundo "Weed control in cassava cultivation in the subhumid tropics" *Tropical Pest Management* 26: 420-6 (1980). (Current wage rates in Nigeria indicate that it is more economical to control weeds in cassava with herbicides.)

J. Parker and R. Vernon "Maize herbicides for small-scale farmers in Zambia" *Tropical Pest Management* 28: 259-65 (1982).

(Herbicide not attractive for oxen owners, but a possibility for those who had to rent tractor service.)

G.L. Denning, et al. "Constraints to the adoption of new weed control technology in rice" in Weed Control in Rice IRRI (1983).

pp. 352-3 gives a review of customary labor arrangements in Asian rice systems and the interaction with herbicide adoption.

E. Davies and S. Shetty "Herbicide research on groundnut and sorghum under farmer conditions in the Indian Semi-arid tropics" Tropical Pest Management 27: 472-9 (1981).

Herbicides shown to be uneconomic in sorghum and groundnut fields.

6. Yield increase

Changes in costs must of course be balanced against expected yield increases due to more efficient weed control. The magnitude of these increases should be estimated.

References:

7. Long-term effects (social profitability)

The use of chemical weed control presents several instances in which a consideration of long-term effects is required. Although these do not appear in a cost-benefit analysis, they are factors which should be taken into account. A few of the most important are discussed here.

a) Employment effects

Chemical weed control is labor-saving, and may affect the

welfare of the rural labor force.

References:

D. Young et al. "Selecting appropriate weed control systems for developing countries" *Weed Science* 26: 209-12 (1978).

(Danger of displacing laborers in northeast Brazil by herbicides.)

H. Biswasnger and S. Shetty "Economic aspects of weed control in semi-arid tropical areas of India" ICRISAT Economics Occasional Paper #13 (1977).

(Herbicide use threatens to displace female laborers.)

E.K. Tan "Pigcawayan, Catabato" in Changes in Rice Farming in Selected Areas of Asia IRRI (1975).

(Reports increased use of hired labor in an area that adopted new rice technology (variety, insecticide, fertilizer, herbicide.)

S. Miller "Economics of herbicide use" Proceedings of the Fifth Asian-Pacific Weed Science Society Conference Tokyo (1975).

b) Soil Conservation

Use of herbicides may lead to decreased tillage, or be part of a conservation tillage program.

References:

D. Taylor, D. Young. "Cost sharing, price supports, and taxes: what it takes to make no tillage competitive in the long run"

AAFA-WAEA Logan, Utah (1982).

c) Changes in weed population

References:

d) Changes in insect population
(to be discussed in Tillage Inventory)

B. Risk

The adoption of chemical weed control implies certain risks for farmers:

If chemical weed control requires a higher cash investment than hand weeding, and if there is a possibility of substantial crop loss through late-season drought, for instance, then it may be that chemical weed control is risky. On the other hand, if chemical weed control means less weed competition, then it may be a risk-reducing technique (See Tillage inventory).

Another risk associated with the use of herbicides derives from the fact that they require considerable experience both in judging the appropriate product for the weed population and in preparing and applying the correct dosage. Recommendations must be understandable to farmers and should be flexible enough to assure that the range of weeds common to farmers in the recommendation domain are controlled. Also, care must be taken in seeing that appropriate techniques are available so that crop damage does not occur.

References:

C. Parker "Appropriate herbicide formulation and packaging for smallholder tropical farmers practicing no-tillage" in No-tillage Crop Production in the Tropics IPPC Oregon (1983).

C. Farming System Compatibility

1. Intercropping and Rotations

The use of herbicide should be checked against possible conflicts with intercrops or rotations. If it looks as if an intercrop may limit herbicide use, production estimates for the intercrop should be made, in order to calculate possible losses, and alternative planting methods may be considered.

References:

J.C. Martínez and J.R. Arauz "Institutional Innovations in National Agricultural Research: On-Farm Research within IDIAP, Panama". CIMMYT Economics Program Working Paper 02/83.

(Example of on-farm tests of phytotoxicity of atrazine in maize for following bean crop.)

Work on Black Sea Coast, Turkey on improved weed control in maize-bean intercrop.

2. Alternate uses of weeds

Weeds are often valued as animal feed and the use of herbicides may threaten this practice. It is necessary to estimate the importance of weeds for animals and to consider alternative sources of fodder. On occasions it may be found that "weeds" are actually part of the diet.

References:

T. Cornick and R. Kirkby "Interactions of crops and livestock production in the generation of technology in sloped areas" Cornell, 1981.

(p.9 Ecuadorian farmers' use of weeds for animals.)

I. Akobundu "Weed control in cassava cultivation in the subhumid tropics" *Tropical Pest Management* 26: 420-6 (1980).

(Use of Talinum in West African cassava fields as vegetable.)

3. Land preparation

If herbicides are being considered, their interactions with land preparation methods must be investigated.

References:

CIMMYT Maize Production Training in Veracruz, Mexico.

(If fields are prepared with a tractor, the clods that are farmed require a higher dose of atrazine. Also, there is some evidence that atrazine's effectiveness is reduced by ashes left from burning plots.)

II Timing or Frequency of Manual Weed Control

A. Profitability

The gains from increased weeding must be balanced against the costs of the extra labor.

B. Risk

Farmers sometimes postpone an additional weeding until they are sure that the rains will be sufficient to produce a good crop.

C. Farming systems compatibility

Where will the extra labor come from? Is there a way of

reducing labor in another enterprise to free labor from weeding?

Reference:

J. Parker and R. Vernon "Maize herbicides for small-scale farmers in Zambia" *Tropical Pest Management* 28: 259-65 (1982).

(Mentions tradeoffs between weeding in cotton and maize.)

OFR in Zimbabwe on timely planting, leading to more timely weeding.

III Intercrops, Cover Crops, Mulches

A. Profitability

What are the labor and input requirements for the second crop. What are its prospects for marketing, home use (food or feed)?

B. Risk

C. Farming System Compatibility

What other activities compete for the labor necessary for the care of the second crop?

References:

Work of ICRISAT on intercrops in weed control

Work of IITA on cover crops, mulches

Velvet bean in on-farm research in Jutiapa, Honduras

IV Equipment

A. Profitability

Availability of equipment, cost. Expected yield increase.

B. Risk

C. Farming System Compatibility

References:

A.H. Druijff, G.J. Kerkhoven "Effect of Efficient weeding on yields of irrigated cotton in eastern Kenya" PANS 16: 596-605 (1970)

(Better hoe design)

J.H. Foster "The economics of the molboard plow and three-time cultivation in two districts in Uttar Pradesh" Indian J. Agr. Econ. 21: 47-66 (1966).

D. Byerlee: Possibility of planting wheat in rows and controlling weeds mechanically; may be cheaper than herbicide (Sonora, Mexico).