GUIDELINES FOR HERBICIDE TESTING AND RECOMMENDATIONS IN ETHIOPIA

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Technical Manual No. 1

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ETHIOPIAN WEED SCIENCE COMMITTEE
The Ethiopian Weed Science Committee (EWSC) was established on 23 November 1982. EWSC is a non-profit, nation wide scientific and educational organization, open to all who are interested in weeds and their control.

EWSC has the following objectives:

- encouraging and promoting the development of knowledge concerning weed science
- promoting unity in research, extension, education, legislation, regulation and other matters pertaining to weeds.
- facilitating and assisting professional contacts between individuals and organizations
- publishing and documenting weed science research results and making information available to users.

Executive Committee members of EWSC 1991-92

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CONTENTS

1. Introduction ................................. 1

2. Objectives ................................... 1

3. Preliminary Considerations .......... 1
   3.1 Safety .................................. 1
   3.2 Priorities ................................. 2

4. Summary of the Testing and Recommendation Process . 2
   4.1 Herbicide Screening ................... 2
   4.2 Schedule of discussion meetings .... 2
   4.3 EWSC Herbicide Recommendation Sub-committee . 3
   4.4 Dossier ................................... 4

5. Initial Evaluation ......................... 4
   5.1 Duration ................................ 4
   5.2 Siting and responsibility ............ 4
   5.3 Methodology .............................. 5
   5.4 Reporting ................................ 5

6. Detailed Evaluation ...................... 5
   6.1 Duration ................................ 5
   6.2 Siting and responsibility ............ 5
   6.3 Factors to considered ............... 5
   6.4 Methodology .............................. 6

7. Verification ................................. 6
   7.1 Responsibility .......................... 6
   7.2 Site selection ........................... 7
   7.3 Treatment ................................ 7
   7.4 Management ............................... 7
   7.5 Replication ............................... 7
   7.6 Statistical design ...................... 7
   7.7 Data collection ......................... 7
   7.8 Analysis .................................. 7

8. Appendices ................................. 8
   8.1 Herbicide recommendation status form . 8
1. Introduction

It is expected that the Regulations pursuant to the Pesticide Registration and Control Proclamation of 1985 will be confirmed and issued sometime in the near future. These regulations will require all pesticides to be ‘registered’ before being approved for sale and use in Ethiopia. And registration will follow... ‘evaluation of comprehensive scientific data demonstrating that the product is effective and not unduly hazardous to human health or the environment’. Information required for registration will include:

- Name and address of registrant or agent (presumably company).
- Name and address of manufacture and place of origin.
- Name under which product will be sold.
- Name and quantity of active ingredient(s).
- Size and type of package in which to be sold.
- Sample labels (including Amoric).
- Sample of the chemical and method of analysis.
- Evidence of safety to distributor and user.
- *Evidence of effectiveness for intended use.
- *Evidence of safety to crop(s).
- Evidence of safety to non-target organisms.
- *Evidence of persistence and movement of residues.
- Methods of disposal of pesticide and package.
- Stability in storage.
- Compatibility with other pesticides.

Many of these pieces of information can only be supplied by the company/agent who will be seeking the registration. For those items with asterisks (*) in the above list, it is envisaged that evidence will be generated at least partially if not largely by IAR and associated institutions. In anticipation of these regulations and in order to generate more generally acceptable herbicide recommendations, the following set of guidelines have been prepared as the basis for producing the evidence that will be required by the Ministry of Agriculture.

2. Objectives

The primary purpose of these guidelines is to ensure that all herbicides made available to farmers and state farms in Ethiopia have been through a suitable process of testing and recommendation so that they are reliable, safe, and economic to the user. Incidentally, the process will provide the basis on which sound evidence is prepared for official registration purposes.

3. Preliminary Considerations

Before any herbicide testing is undertaken consideration should be given to:

3.1 Safety. Shortly there should be legislation limiting the range of pesticides which can be introduced to Ethiopia for testing and development. Until these regulations are formulated, IAR is
preparing some interim guidelines based mainly on the W.H.O. classification, such that compounds in the 'extremely' or 'highly' hazardous groups will not normally be permitted into IAR research programs. The question of new compounds under development which are not yet listed by W.H.O. has not yet been resolved and requires further discussion. It would seem sensible generally to preclude 'coded' compounds for which full chemical and toxicological information is not yet available. Some exceptions might need to be allowed for more basic studies, especially where it is desirable to compare a range of compounds within a chemical group, some of which might be in an earlier stage of development than others.

3.2 Priorities. In Ethiopia the subject of herbicide use is still controversial. Objections can be expressed on environmental grounds of the difficulty of educating farmers in their use, but most especially because of the expenditure of foreign exchange. It is especially important therefore that the country's limited research resources should only be devoted to those herbicides which are fully relevant to the Ethiopian situation. Some criteria for a herbicide testing program would be:

a. where herbicides could solve an especially difficult problem which is at present technically beyond the farmer's traditional techniques,
b. where herbicides could increase crop yield and result in a high marginal net benefit, when compared with the current practice,
c. where herbicides could solve a critical bottle-neck in weeding needs during peak periods and allow more productive use of available labor.

4. Summary of the Testing and Recommendation Process

4.1 Herbicide screening. Generally, all herbicides should pass through the following stages of testing: Initial Evaluation, Detailed Evaluation and Verification, in order to have the pertinent information in the 'recommendation dossier'. However, initially each candidate herbicide must be judged according to the Herbicide Recommendation status Form to see where it may enter the process.

A 'Herbicide Recommendation Status Form' is proposed as a means of checking that adequate information is available for full recommendation, or conversely that more information is needed. (A draft of the proposed form is appended).

Every effort has to be made to determine what is already known about a particular herbicide for the intended target problem. It may be justified to accelerate the testing program, e.g. by skipping the Initial evaluation stage, where there is abundant information and experience already available from other countries, especially those with comparable ecology. A review of such previous information should also be prepared for inclusion in the 'recommendation dossier' to be submitted eventually to the National Herbicide Recommendation Committee. Herbicides that have already been tested and even 'recommended' in Ethiopia for some time may also need to be appraised systematically in the same way.

4.2 Schedule of discussion meetings. Up to the present there have been no satisfactory mechanisms for discussing priorities and agreeing on the main programs of herbicide development (or other aspects of weed research). It is therefore proposed that on an annual basis there should be the following meetings:

4.2.1 A bilateral meeting between IAR and user groups. This would be held between IAR and IAR's user groups (MSFD, MOA, and MCTD). Participants could also include the National Weed Science Coordinating Unit (whose creation is being separately proposed), other key weed
science personnel (from IAR, PPRC, or AUA) most closely involved in collaborative research with the respective user groups, and observers from the companies.

Objectives would include:

a. Appraisal of outstanding weed problems and research needs.
b. Feedback on performance and limitations of available herbicides.
c. Agreement on new herbicides to be brought into research.
d. Agreement on other non-chemical research priorities.
e. Provisional agreement on transition of herbicides or other techniques to the verification stage and the relative responsibilities of IAR and each user group in this process. Such agreements would be provisional on the outcome of the current year’s trial results and subject to revision at a special confirmatory meeting on verification at a time in the year when trial results are available, and before finalization of IAR research proposals.
f. Agreement that a testing process is completed and allocation of responsibility for finalizing a recommendation dossier in conjunction with the company/agent.

The time of the meeting would be set so as to occur prior to IAR pre-view meetings, and if possible, directly following the Annual EWSC meeting.

N.B. It may be noted that the reporting of research results is not included as a specific item above. These will naturally be a topic of discussion, but it is envisaged that these will have been more formally presented at the annual meeting of the EWSC.

4.2.2 IAR National Weed Science Meeting. This meeting would primarily involve IAR staff including all weed science staff plus selected representatives from agronomy, farming systems and Research/Extension Liaison Committee as well as PPRC and AUA. It could directly follow the bilateral meeting (4.2.1).

Objectives would include:

a) To report and discuss conclusions from the above 'bilateral' meetings, in terms of the weed problems and 'feed-back'.
b) To discuss and confirm the main priorities in herbicide and non-chemical weed research.
c) To agree on the relative responsibilities of different centers and sections for the preparation of new research proposals, and for implementation of 'verification' trials.

N.B. Similar meetings may also be required within MOA and MSFD

4.2.3 Joint verification meetings in January/February. This meeting would involve staff of IAR, MOA, and MSFD concerned with verification trials and would consider the previous season’s trial results and confirm or otherwise the previous tentative proposals for verification trials.

4.3 EWSC Herbicide Recommendation Sub-committee

It is proposed that a permanent EWSC sub-committee be created with the following structure and functions.

4.3.1 Structure. The Committee will have as core members representative weed scientists
from IAR, MOA, and MSFD. Additional members (co-opted) might include other IAR weed scientists, agronomists or economists and/or representatives from MCTD, PPRC, etc.

It could be that temporary ad-hoc Sub-committees might be specially formed to consider specific recommendation proposals. The composition of these ad-hoc groups would reflect expertise in the crop area under consideration.

4.3.2 Functions

a) To consider (within 3 months of receipt) proposals for herbicide recommendations submitted either by research organizations or by agrochemical companies/agents.

b) To approve a dossier of information supporting the technical aspects of a proposed recommendation, such that it is suitable for passing to the MOA Pesticide Registration Committee (together with other information to be provided by the company/agent).

c) Where necessary, to advise the applicant(s) what further information is needed before the proposal can be submitted for approval.

d) To amend or change the Guidelines for Testing Herbicides procedure it is deemed necessary.

4.4 Dossier. The dossier to be presented to the Sub-committee shall include:

a) A background statement on the proposed recommendation based on literature and any experiences of the recommended treatment in other countries, especially those closest geographically and ecologically to Ethiopia.

b) Evidence of ‘clearance’ on toxicological grounds (we anticipate some regulation limiting the compounds that can be brought into research programs).

c) Trial results from Initial, Detailed and Verification Trials.

d) Completed Recommendation Status Form

e) Specimen label/recommendation leaflet.

5. Initial Evaluation

The objective of this stage of testing is mainly to establish the technical suitability of a herbicide for the target crop and weed problem.

5.1 Duration will normally be only 1 or at the most 2 seasons.

5.2 Siting and responsibility. This stage will normally be conducted at one or more of a limited number of IAR research centers by senior weed science staff, but where the problem demands, other centers and/or PPRC and AUA may also be involved. A single site may be adequate provided conditions are suitable. The site(s) chosen should be representative of the problem and where the problem exists.

5.3 Methodology. General guidelines include:

- A wide range of doses (normally 3) is essential. A ‘logarithmic’ sprayer may be used to achieve a range of doses.
- Available herbicide(s) may need to be included for comparison purposes.
- Target weeds may need to be supplemented by artificial sowing.
- Non-target weeds may need to be controlled by a blanket spray or by other means to avoid confounded results.
- Crop yields need not be taken, but crop responses must be carefully assessed by appropriate scoring or measurement.
- Control of target (and other) weeds should be assessed by appropriate scoring or measurement.

5.4 Reporting. Each trial should be written up in adequate detail and a copy made and kept for eventual inclusion in the 'recommendation dossier' to be submitted to the National Herbicide Recommendation Committee.

N.B. A more detailed methodology and reporting guide is being prepared as a supplement to this document.

6. Detailed Evaluation

The objective of this stage is to take those treatments found promising in the previous stage and expose them to a wide range of varying factors and conditions and thus determine the optimum and any limiting conditions for their safety and effectiveness. Decision on progressing to this stage will be made by IAR weed staff at an annual meeting (see 'meeting schedule' above).

6.1 Duration. At least 2 years and more often 3 will be required to generate adequate information for on-farm verification.

6.2 Siting and responsibility. Sites will be mainly on IAR, PPRC or AUA research centers and sub-centers where the crop/problem is available. If the problem does not exist on these sites, others can be used by arrangement, such as MSFD State Farms, ADD trial sites, etc. Within IAR, responsibility will be with relevant weed science staff in conduction with agronomy/crop physiology and farming systems research teams as appropriate.

6.3 Factors to be considered. These will vary according to the crop and weed problem and the mode of action of the herbicide, but might include:

6.3.1 Weed factors:
- range of species controlled
- time of application in relation to the weed growth stage
- source, clone, biotype, or exact taxon of the weed (e.g. particular species of Cynodon or Avena)

6.3.2 Crop factors:
- time of application in relation to stage of growth of crop
- crop variety (e.g. a few contrasting varieties might be included to determine if there is any pronounced interaction with cultivar)
- sowing method - broadcast versus drilled

6.3.3 Environmental factors:
- rainfall - not usually controllable but observations are needed on herbicide performance under different (recorded) rainfall patterns
- soil type - especially with soil-acting pre-emergence herbicides
6.3.4 Application factors:
- spray versus granule application
- type of liquid application/volume of spray liquid/weed wiper versus sprayer
- addition of wetting agents
- normal pre-emergence application versus pre-sowing incorporation
- compatibility with other herbicides/pesticides

6.3.5 Agronomic factors:
- interaction with land preparation, fertilizer application, other weeding methods, etc.

6.3.6 Safety factors:
- risk of residues or drift affecting non-target crops
- ease of handling and risk considering type of users

6.3.7 Economic factors:
- potential benefits in economic terms, both direct and indirect, resulting from e.g. increased yield,
  reduced weeding requirement, etc.,
- ease of use

6.4 Methodology

- Several doses still need to be included, including one approximately double the expected use level,
  to determine risk of damage from overdosing.
- Replicated trials to be taken through to yield to allow preliminary economic analysis.

N.B. For detailed methodology and reporting, a supplement is being prepared.

7. Verification Trials

The objective of this stage is to confirm safety, effectiveness, profitability, and reliability under a
wide range of soil, climate and farmer management conditions, using the normal farmer practice
as a standard. Individual trial objectives should be clear. Verification trials will be relevant for state
farms, small or co-operative farms or both.

7.1 Responsibility should be as follows:

a. cooperatives and peasant farms - IAR (CP and FSR Depts) with MOA (CRPD and ADD),
b. state farms - IAR (CP Dept.) with MSFD,
c. coffee state farms - IAR (CP Dept.) with MCTD.

7.2 Site Selection and Trial type. Only perform trials where the problem exists and choose sites
carefully according to environment (soil and rainfall), management type, weed species, etc. Sites
can be stratified across identified gradients. Decide on which factors are most important for site
selection. Within a given farm or site, choose a uniform location which has the characteristics needed.
Avoid unusual areas or those prone to animal damage, etc.

a) On-station sites are researcher managed on IAR, ADD or IAR/ADD sites, State Farms or
   Coffee Estates.
b) On-farm sites are jointly managed trials between researcher or site manager and the farmer.
Each of these types can be done concurrently or in sequence depending on the stage of development of the information.

7.3 Treatment selection. Choose the 'best bet' treatments and compare with the common practice. Treatments should be jointly decided by implementors and should be kept as uniform across sites as possible. Make the trial simple and treatment number relatively small.

7.4 Management

a) For on-station sites set management of non-experimental variables such as plant population, spacing, fertilizer, etc. at or near the farmer's level. Plot size may be large, especially on MSFD and MCTD sites.

b) For on-farm sites researcher/extensionist may be involved in the herbicide application, plot layout, site selection and data collection but the farmer should be directly involved in managing the non-experimental variables at his level.

7.5 Replication. For on-station sites replicate at least 3 times. For on-farm sites, replicate at least 2 times.

7.6 Statistical design. Use a simple RCBD or CRD. Plan to analyze each site separately as well as combined across sites. Sites can be grouped according to any major characteristics and compared.

7.7 Data Collection

General information including: site data such as field history, location, etc.; soil type; dates for land preparation, planting, crop emergence, growth stage, etc.; weed species present; spraying details; rainfall data; weed scoring and/or counts before and after each weed control treatment, including special notes on effects of herbicides on dominant weeds (and crop); effects of non-experimental variables on herbicide performance; labor data (relative) for use in economic analysis; and harvest data.

For on-farm trials additional data should be taken: information on farmer management of non-experimental variables, including number of ploughings, land preparation methods, planting method, dates of operations, seeding rate, etc. Note the site history, the farmer's own weeding practice(s) inside as well as outside the trial area and possible supplemental weeding done on herbicide treated plots. Especially note the farmer's assessment of each experimental treatment tested (which he likes best and why).

7.8 Analysis

Generally the analysis should include: yield; weed-related information; economic analysis of treatments and labor data. (Do a sensitivity analysis); across site comparisons; discussion of interactions with other enterprises, both positive and negative, considering economic and sociological factors; for on-farm sites, site variables (such as soil type, a particular management factor, weed flora composition) may be regressed with yield and farmer assessment.

Combine farmer assessment, visual assessments, economics, and statistics in order to make a final conclusion.
8. Appendix 1.

8.1 Herbicide Recommendation Status Form

A. Proposed Recommendation

<table>
<thead>
<tr>
<th>CROP</th>
<th>HERBICIDE/HERBICIDE MIXTURE</th>
<th>DOSE (a.i. ha⁻¹)</th>
<th>TIMING/CROP STAGE OF GROWTH</th>
<th>WEEDS CONTROLLED/NOT CONTROLLED (susceptibility to recommended dose(s))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Species</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Susceptibility ... S = susceptible at seedling and later stages and under wide range of conditions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MS = susceptible only at early stage and under good conditions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MR = partially controlled only under good conditions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R = resistant under all conditions</td>
</tr>
</tbody>
</table>

Species Susceptibility ... S = susceptible at seedling and later stages and under wide range of conditions

MS = susceptible only at early stage and under good conditions

MR = partially controlled only under good conditions

R = resistant under all conditions
B. Check List of Possible Limitations/Qualifications

1. REGION (any area in which recommendation not applicable?)

2. CROP SAFETY  
   a) variety  
   b) stage of growth  
   c) effect of overdose

3. SOIL TYPE

4. RAINFALL  
   a) before (e.g. effect of dry soil or previous drought conditions)  
   b) after (e.g. danger of excess rainfall following, either causing damage or reducing effectiveness)

5. TEMPERATURE (risk of crop damage due to high temperatures or frost?)

6. RELATIVE HUMIDITY (poor performance under very low R.H?)

7. APPLICATION METHOD  
   a) volume (range suitable for normal performance)  
   b) aerial/ulv possible?  
   c) incorporation into soil needed?

8. FORMULATION/ADDITIVES (any needed, or to be avoided)

9. PROTECTIVE CLOTHING  
   a) for handling concentrate?  
   b) for application?

10. COMPATIBILITY WITH  
    a) other herbicide  
    b) other pesticides

11. RISK TO NON-TARGET CROPS  
    a) by drift (maximum wind speed?)  
    b) by residues

12. RESIDUES IN CROP PRODUCE

13. NEED FOR SUPPLEMENTARY WEEDING

14. AGRONOMIC PRACTICES  
    a) planting method (e.g. broadcast versus drilled)  
    b) fertilizer  
    c) land preparation  
    d) other?

15. ECONOMICS

C. Status