Direct sowing, mulch-based systems and conservation tillage: finding common ground

Proposal for a Global Program under GFAR

A proposed Global Program

GFAR, the Global Forum on Agricultural Research, guided by agreed basic principles, is progressively developing a global system on agricultural research. GFAR Global Programs aim to “pull together and transform decentralized initiatives into global initiatives using a bottom-up approach”. This aim flows directly from two GFAR guiding principles: subsidiarity and additionality.

As a first step, five research areas have been selected as being of high priority for global cooperation. One of these is Natural Resources Management and Agroecology (NRM/A). This note proposes a GFAR Global Program on direct sowing, mulch-based systems and conservation tillage, within the NRM/A research area.

To achieve the aim of a Global Program, it is necessary to squarely face the central question of how to use a bottom up approach to pull together and transform numerous decentralized initiatives (in this case, those local initiatives on direct sowing, mulch-based systems and conservation tillage) into a coherent global program. The rest of this note describes we propose that this central question be addressed.

First, the goals and objectives of the proposed Global Program are described, and activities for meeting these goals and objectives are outlined. Then, a brief review is provided of key issues to be addressed in the Global Program. After this, examples are given of local initiatives active in different parts of the world in direct sowing, mulch-based systems and conservation tillage. The participation of these in a bottom-up approach is then discussed and questions of Global Program governance and implementation are examined.

Goal, purpose, and objectives

The proposed Global Program on direct sowing, mulch-based systems and conservation tillage (DMC) has a broad developmental goal:

To help improve rural livelihoods and eliminate poverty, while conserving natural resources and encouraging more durable forms of agriculture, by fostering broader use of sound agroecosystem management practices, especially those centered on direct sowing, mulch-based systems and conservation tillage.

1 Draft report from a meeting held at CIRAD, Paris during the dates January 20-21, 2000.
2 Research programs may be better managed at a sub-regional or regional level rather than at a global level. Therefore, planned activities should be implemented at the lowest level possible at which they can be executed.
3 GAR will only facilitate the emergence of Global Programs when stakeholders perceive the added value of working together at the regional and/or global level.
In order to achieve this goal, the Global Program on DMC has the following purpose:

To strengthen the capacity of key stakeholders to develop suitable DMC systems, and to accelerate their widespread adoption.

The proposed Global Program proposes to meet this purpose by achieving specific objectives:

• Provide a framework for analyzing and comparing stakeholder experiences with DMC systems.
• Synthesize and systematize lessons learned from decentralized initiatives.
• Identify gaps in what is known about developing and fostering the use of DMC systems, and encourage stakeholders to fill these gaps.
• Provide support and feedback to decentralized stakeholder initiatives.
• Foster the multiplication of successful experiences.

Global Program activities

The objectives of the proposed Global Program call for a global learning process. By analyzing and comparing experiences from decentralized initiatives, by synthesizing and systematizing lessons learned, and by identifying and filling gaps, stakeholders can be more effective. They can more swiftly develop more suitable DMC systems, and more effectively encourage their widespread use. In doing so, they can draw on the keys to success, while avoiding known pitfalls.

Select and characterize decentralized initiatives

A first set of activities, then, is to select and characterize decentralized initiatives on DMC systems. That is, the Global Program begins with a bottom up approach. Given the huge number of decentralized initiatives on direct sowing, mulch-based systems and conservation tillage, it may be necessary to develop selection criteria to help decide which initiatives will be emphasized within the Global Program. Clearly, such selection criteria must take account of the willingness of the decentralized initiative to work with (and learn from) the Global Program, as well as the lessons that may be extracted from it. An initial step, then, may be the development of a full inventory of potential case studies, to which selection criteria may be applied.

Extract lessons from selected initiatives

Once decentralized DMC initiatives are chosen that will be emphasized in the Global Program, a framework for analyzing and comparing them needs to be developed. Such a framework will contain the following elements:

• The process of technology generation and adoption followed in the initiative, from the initial conception to the final steps in accelerating adoption.
• Information on the management of the research and development process.
• Information on partnerships, and how these influenced the performance of the initiative.
• Information on the biophysical performance of the technologies developed by the initiative, as related to environment and agroecology.
• Factors governing adoption of the technologies developed by the initiative.
• Selection of criteria that distinguish initiatives with greater success from initiatives with less success.
• For those initiatives judged to be relatively successful, factors explaining “why it worked”.
• For those initiatives judged to be less successful, an analysis of problems that occurred.
• Synthesis of lessons learned, identification of gaps, and filling of these gaps through work to improve research methods and processes.

Organize, manage and circulate information
The Global Program proposes to share information on lessons learned on processes of developing and fostering adoption of DMC practices. This will be done through the use of fiches, development and application of databases, utilization of study tours, and other forms of feedback to local DMC initiatives.

Databases may feature the Interdev system promoted by the NGO committee. This is a project management information system (PMIS) that describes who is doing what, where, under what conditions, and with what results. APAARI and the Rice-Wheat Consortium are developing a similar system for the Indo-Gangetic Plains. CIMMYT also uses the Sustainable Farming Systems Database (SFSD) for similar purposes (SFSD is compatible with the CGIAR-wide standards for ICIS – International Crop Information Systems). And there are other options. The Global Program can sort through functional requirements and design issues for the database system of choice.

Of course, databases are only as good as the information that goes into them. Managers of decentralized initiatives may be reluctant to share information. Suitable IPR rules will be needed that protect the rights of those generating the data, while making as much as possible available for the common good. One approach may be to use “date stamping”: define a date before which only data summaries are publicly accessible, but after which all data become available. This gives time for scientists to publish (and get recognition for) their work.

Other issues in database development and use include frequency of updates; clearly designated responsibilities for database management (“curator”); staffing and resourcing (“who is going to do it? And who is going to pay for it?”); deadlines and scheduling; mode of database access (e.g., CD vs. net-enabled); and training in data entry, quality control and – especially – querying.

The use of standardized “fiches” may be a good way to initiate data management efforts. Fiches contain summarized data in standard format for easy access and comparison. They are readily prepared and used even before an electronic database is up and running.

If, however, it is true that the objectives of the proposed Global Program call for a global learning process, that database management and use may not be enough. At times there is simply no substitute for personal exchanges and field visits. The Global Program, then, will implement a program of study tours. The first of these will be to
visit selected decentralized initiatives in Brazil. Subsequent visits may be made to selected initiatives in Asia and Africa.

Engage in networking

Drawing on the activities described above, the GFAR Global Program on direct sowing, mulch-based systems and conservation tillage will engage in networking activities, including:

- Exchange of exchange;
- Promotion of new DMC initiatives;
- Development of links to other Global Programs and networks with similar interests;
- Identification of training opportunities of interest to the various decentralized initiatives; and
- Provision of opportunities for documenting and publishing lessons learned on effective and efficient DMC research.

Key issues

As the Global Program on direct sowing, mulch-based systems and conservation tillage engages in the above activities, striving to accomplish its goals, purpose, and objectives, it will need to deal with a number of key issues. These issues are central to the success of DMC practices. Some relate to the plot or farm level, others to the watershed or region. Similarly, some pertain to technology design, others to its attractiveness to farmers, and still others to the consequences of technology adoption.

- **Mechanization**: Widespread adoption of DMC practices often depends on the availability of adequate implements. Lessons from the USA, Brazil and South Asia point in this direction. Where implements are not adequate, farmers may be unable to attain good crop establishment. Farmer experimentation with implements, in collaboration with small-scale machinery shops, NGOs and other actors is often necessary.
- **Integrated weed/pest management**: Direct sowing with conservation tillage practices often results in increased weed problems. Ways may need to be found to overcome this. Crop residues may also facilitate pest carryover from one crop to another. Integrated management practices may be required.
- **Substitution of herbicides**: Weed control strategies may need to follow an integrated approach, so as to reduce reliance on herbicides. Shading strategies, combined with reduced soil movement, can have important roles.
- **Role of mulching**: Organic mulches on the soil surface can: slow rainfall run-off, improve soil moisture, reduce erosion, foster improved soil microbiological activity, improve soil fertility, reduce weed germination, facilitate land preparation, etc. It is important to know which of these are most important in a particular case.
- **Residue/biomass management**: To attain a suitable mulch cover at the onset of sowing, crop residues and other biomass needs to be suitably managed, e.g., reduced burning, reduced incorporation, controlled grazing, etc.
- **Use of local (legume) species**: Green manures for mulch may be drawn from local species, not necessarily from the same restricted set of introduced species.
• Integration crop-livestock: DMC systems may be difficult to introduce when there is heavy livestock grazing pressure on crop residues. Fodder crop production may be necessary, or controlled grazing practices introduced at the community level.

• Germplasm: Some crop varieties may do better than others when used with DMC practices. Breeders may need to set up programs to develop varieties tailored for use with direct sowing, mulch, or conservation tillage.

• Use of external inputs: In some instances, DMC practices may allow external input use to be wholly eliminated. In other instances, it may make sense for these practices to be complemented with judicious applications of inputs. In any event, DMC practices should lead to higher use efficiency of any inputs that may be used – greater productivity with fewer inputs.

• Recuperation of soil fertility: Local decentralized initiatives may have long-term as well as near-term objectives. Among longer-term objectives may be found the recuperation of degraded soils.

• Short- vs. long-term profitability: As a practical matter, most farm-level decisions are taken on the basis of short-term profitability. DMC practices may need to demonstrate near-term benefits to be attractive to farmers.

• Constraints to adoption: Adoption of DMC practices may be constrained by poor access to implements or green manure seeds, inadequate technology performance, subsidies on external inputs, and other factors. These need to be understood.

• Sociological factors: Adoption of DMC practices may also be constrained by social factors, e.g., communal grazing of livestock that leaves no organic matter for mulch, or widespread burning that moves from one field to another.

• Policies: National, regional, or municipal policies can affect the extent to which DMC practices may be attractive. For example, a municipal prohibition on burning of crop residues may make DMC practices the best option for farmers.

• Environmental impacts: The introduction of DMC practices may lead to environmental benefits not taken into account by farmers as they take adoption decisions. Some examples include reduced nitrates in groundwater, reduced nitrous oxide emissions, improved agroecosystem biodiversity, improved carbon sequestration (through higher levels of soil organic matter); reduced soil erosion, improved downstream water quality; etc.

Some local initiatives

There are many local initiatives currently working on direct sowing, green manures, mulch-based systems and/or conservation tillage. Here are some of them:

• Direct sowing with conservation tillage and mulch in Brazil and other parts of the Southern Cone of South America (numerous stakeholders)

• Direct sowing with conservation tillage and mulch in Mexico (CIRAD, CIMMYT, INIFAP, others)

• NGO networks on green manure cover crop use in Central America and Southern Mexico (NGOs, Rockefeller Foundation)

• Intercrops and rotations in Southern Africa (e.g., maize - mucuna rotations and maize + pigeon pea intercrops in Malawi, maize – soybean and maize – groundnut rotations in Zimbabwe) (Soil Fertility Network)

• Conservation tillage for soil moisture management in drought-prone areas of Southern Africa (Silsoe international, NARS)

• No till in Madagascar (list institutions)
• Agroforestry examples from Eastern Africa (ICRAF, African Highlands Initiative)
• Examples from West Asia/ North Africa (ICARDA to supply examples)
• Zero till crop establishment, Chinese Hand Tractor minimum till systems, surface seeding practices, in the Indo-Gangetic Plains of South Asia (CIMMYT, the Rice-Wheat Consortium for the Indo-Gangetic Plains)
• Mulch-based systems in Laos and Vietnam (CIRAD, IBSRAM, IRRI)
• Many others . . .

**Governance and the Global Program**

The proposed Global Program on direct sowing, mulch-based systems and conservation tillage aims to respect the general principles of GFAR: it will be specifically linked to GFAR; it will be open to all; it will be a framework for collaboration, not an institution in itself; it will require a voluntary action team to further develop the proposal and carry it forward.

Members of the Global Program may extend well beyond those who were able to attend the first “launch” meeting in Paris. Still, some suggestions were made at that meeting regarding interim membership, representation, and next steps.

- Overall leadership of the Global Program should be vested in CIRAD.
- CIMMYT should represent the CGIAR system as a whole, though individual Centers may be members.
- Madagascar may wish to represent the Southern Africa region.
- ICARDA may wish to represent West Asia/ North Africa region.
- Other strategic stakeholders need to become involved, among them FAO, the World Bank, the French Ministry for Foreign Affairs, GTZ, ARIs, universities (e.g., Cornell), farmers associations, IFDC, etc.

The need for an Executive Committee was noted. For the interim, and in preparation for the Dresden MTM meeting of GFAR, it was suggested that the Executive consist of Henri Rouille d’Orfeuil for CIRAD, Larry Harrington for CIMMYT, and Jean Marc Von der Weid for ASPTA/ Brazil.

In the interim before the Dresden meeting, it was suggested that:

- Paris meeting participants be consulted to improve and finalize this note.
- A general document for Dresden by developed.
- That document to be circulated for comment to regional fora and strategic stakeholders.
- That resourcing aspects be further developed.
- That a few “sample” fiches be produced
- That post-Dresden, resources be identified for continuity.
- That another meeting be held to review progress and plan further steps.
- That several concrete steps be in place before the end of the year 2000, among them a prototype of the Interdev database, and at least one round of study tours.