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POPULARIZATION OF CONSERVATION AGRICULTURE THROUGH AGRICULTURAL EXTENSION SYSTEM

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Soil is the most wonderful gift of nature to human society. Five of the top ten problems facing humanity over the next 50 years (food, water, energy, environment and poverty) are directly related to soil health. Inappropriate agricultural practices, excessive tillage, unsuitable crop rotations, excessive grazing, crop residue removal, deforestation, mining and construction have contributed to soil degradation. There is need to understand and implement sustainable agricultural and land management practices that improve soil health and mitigate change in environment. Many developed countries are following conservation agriculture practices. USA is the pioneer country with highest area under conservation agriculture as compare to other countries. In India, its adoption is still in the initial phase. According to 2018-19 data, the USA has the highest number of acres (108.8 million), followed by Brazil with 106.2 million acres and Argentina with 81.3 million acres cropland used for conservation agriculture (Michaela Paukner, 2022). Spread of conservation agriculture has been made through the combined efforts of several State Agricultural Universities, ICAR institutes. Agricultural extension services are responsible for transfer technologies developed by agricultural research institutes. Extension personnel can follow certain innovative approaches for promotion and adoption of conservation agriculture.

What is Conservation Agriculture (CA)?

Conservation agriculture is a way of farming that conserves, improves and ensures efficient use of natural resources. FAO, 2008 defined conservation agriculture is a concept for resource-saving agriculture crop production system that strives to achieve acceptable profits together with high and sustained production levels while conserving the environment. CA builds ecological foundation for agriculture. It has potential to arrest or reverse land degradation, boost productivity and increases food security. Provides soil fertility, saves money, time and fossil fuel. It is efficient alternative to traditional agriculture.

CA is characterized by three interlinked principles namely minimum mechanical soil disturbance, maintaining permanent organic soil cover and diversified crop rotations. These three pillars ensure improvement or maintenance of soil organic carbon at desired level.

1. Minimum Mechanical Soil Disturbance

Minimum soil disturbance means no tillage/zero tillage. It is way of growing crops or pasture from year to year without disturbing the soil through tillage. No till approach started from 1960s by farmers in India. It is followed in the Indo-Gangetic plains where rice-wheat cropping is present. It has several advantages like reduction in crop duration, reduction in cost of inputs for land preparation, residual moisture effectively utilized therefore number of irrigations get reduced, addition of dry matter and organic matter in soil, reduction in greenhouse effect by carbon sequestration.

2. Maintaining Permanent Organic Soil Cover

A permanent soil cover is important to protect the soil against the deleterious effects of exposure to rain and sun, to provide the micro and macro-organisms in the soil with a constant supply of food and alter the microclimate in the soil for optimal growth and development of soil organisms, including plant roots. In turn it improves soil aggregation, soil biological activity, soil biodiversity and carbon sequestration.

3. Diversified Crop Rotations

Crop rotation refers to recurrent succession of crops on the same piece of land either in a year or over a longer period of time. The rotations of crops are not only necessary to offer a diverse diet to the soil micro-organisms, but also for exploring different soil layers for nutrients that have been leached to deeper layers that can be recycled by the crops in rotation. Cropping sequence and rotations involving legumes helps in minimal rates of buildup of population of pest species, biological nitrogen fixation, control of off-site pollution and enhancing biodiversity.

Constraints in Adopting Conservation Technologies

The most important factor in the adoption of CA is overcoming the bias or mindset about tillage. It is argued that convincing the farmers that successful cultivation is possible even with reduced tillage or without tillage is a major hurdle in promoting CA on a large scale. In many cases, it may be difficult to convince the farmers of potential benefits of CA

beyond its potential to reduce production costs, mainly by tillage reductions. CA is now, considered a route to sustainable agriculture. Spread of conservation agriculture, therefore, will call for scientific research linked with development efforts. The following are a few important constraints which impede broad scale adoption of CA.

1. Lack of appropriate seeders especially for small and medium scale farmers: Although significant efforts have been made in developing and promoting machinery for seeding wheat in no till systems, successful adoption will call for accelerated effort in developing, standardizing and promoting quality machinery aimed at a range of crop and cropping sequences. These would include the development of permanent bed and furrow planting systems and harvest operations to manage crop residues.

2. The wide spread use of crop residues for livestock feed and fuel: Specially under rainfed situations, farmers face a scarcity of crop residues due to less biomass production of different crops. There is competition between CA practice and livestock feeding for crop residue. This is a major constraint for promotion of CA under rainfed situations.

3. Burning of crop residues: For timely sowing of the next crop and without machinery for sowing under CA systems, farmers prefer to sow the crop in time by burning the residue. This has become a common feature in the rice-wheat system in north India. This creates environmental problems for the region.

4. Lack of knowledge about the potential of CA to agriculture leaders, extension agents and farmers: This implies that the whole range of practices in conservation agriculture, including planting and harvesting, water and nutrient management, diseases and pest control etc. need to be evolved, evaluated and matched in the context of new systems.

5. Skilled and scientific manpower: Managing conservation agriculture systems, will call for enhanced capacity of scientists to address problems from a systems perspective and to be able to work in close partnerships with farmers and other stakeholders. Strengthened knowledge and information sharing mechanisms are needed.

(Bhan and Behera, 2014)

Agricultural Extension System and Conservation Agriculture

- If Conservation Agriculture is effective, then a key question would be to ask why it is not spreading more rapidly.

- There are number of reasons for farmers not spontaneously adopting CA, despite the acknowledged advantages.
- Agricultural extension services proven better in delivery of information to farmers because of established infrastructure, reach to many people, community trust, cultural awareness, empathy and understanding and more knowledge.
- Farmers presently require a different kind of support from agricultural extension than they received in the past.
- Farmers are the primary decision-makers and movers of change, but they have also suffered because of the adverse impacts of agrarian changes.
- Extension workers need to facilitate farmer self-development through empowering them and helping to improve their ability to manage change.
- Agricultural Extension Agencies and farmers need to receive adequate training and education in CA technologies for sustainable food production.
- As many of the technologies for rain fed agriculture are knowledge-based and need community action, farmers' groups have to be organized and sustained at the grass roots level.
- It is a greater need to emerge new institutional arrangements in partnership with the private sector (input firms, farmers' associations, NGOs, etc.) for providing extension services.
- Extension services should adopt participatory approaches (in technology development and transfer), decentralized planning, managing common property resources, group approaches to technology transfer, wider use of mass media and information and communication technology.

Role of Agricultural Extension Agencies in Popularization of Conservation Agriculture

The agricultural extension agents of different universities, research institutes, KVKs, etc, must play following roles for popularization of conservation agricultural practices,

1. Knowledge disseminator

Knowledge is the main barrier in adoption of conservation agricultural practices. There is a need to think differently about how knowledge is spread to farm families. Additionally new research knowledge on CA systems generated on-farm and on-station is also required to advance their further development and adoption.

2. Educator

Sustainable agriculture production should be featured prominently in the curriculum of colleges and universities. For a broader focus on ecologically-based, resource conserving agriculture based on the core CA principles in all settings for sustaining the production of crops and water from all landscapes.

3. Planner

Planning a programme related to CA technologies like awareness campaign, trainings and demonstration for farmers, youth, SHGs etc.

4. Organizer

Farmers tend to believe trusted peers more than their formal advisers when discussing innovations, making it easy for them to exchange ideas and experiences. Organizing group of such farmers is beneficial. Also organizing training and demonstration to them on CA practices helps to enhance adoption.

5. Demonstrator

Agricultural extension agencies act as a demonstrator for farmers related to relevance and feasibility of CA technologies. Demonstrations should be arranged on farmers field. Example Demonstration of crop residue management technologies.

Farmer to Farmer Extension

Farmer-to-farmer extension may have a role to play in overcoming the information access problems and lack of knowledge that may preclude widespread adoption.

- ✓ First, lead farmer motivation increases their effectiveness at diffusing CA practices to their followers.
- ✓ Second, lead farmer familiarity with and adoption of CA both matter to the spread of CA practices, but familiarity appears more important.
- ✓ Third, lead farmers play a more critical role in increasing awareness than adoption of the CA practices.

(Monica Fisher *et al.*, 2018)

Involvement of Youth

- ✓ The limited involvement of young people in small-scale farming poses a threat to the sustainability of new methods of farming practices such as no-till CA.
- ✓ However, the attitudes of young people towards farming need to be changed, and conditions need to be created that support their entry into farming at an early stage of their lives.
- ✓ Increasing extension contact with farmers is important in influencing the adoption of CA. More young people need to be trained as extension agents.

Conclusion

Conservation agriculture technologies are the future of sustainable agriculture. Conservation agriculture practices such as conservation tillage, residue and land cover management, appropriate crop rotation have shown the proven benefit to improve soil quality across the world. The benefits range from nano-level (improving soil properties) to micro-level (saving inputs, reducing cost of production, increasing farm income), and macro-level by reducing poverty, improving food security, alleviating global warming.

There is need to promote and adopt conservation agricultural practices. Overcome past mindset of farmers and explore new opportunities, crop residue burning, lack of knowledge are the major constraints in adoption of conservation agriculture. Conservation agriculture can be popularized with the help of increasing awareness, giving subsidies on machineries, organizing participatory research and demonstrations and establishing network of practicing farmers. Agricultural extension services play major role in adoption and promotion of conservation agricultural technologies. Agricultural extension agencies and farmers need to receive adequate training and education in CA technologies for sustainable food production. Involvement of lead farmers and young generation in conservation technologies influences adoption of CA.

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