ADVANCING ZERO-TILL

Policy Brief Recommendations in Support of Accelerating the Adoption of HS/ZT Seed Drills Across the Indo-Gangetic Plains

PURPOSE AND OUTCOMES OF THE STUDY

The Australian Centre for International Agricultural Research (ACIAR) through the Sustainable Development Innovation Portfolio (SDIP) commissioned the University of Adelaide's Centre for Global Food and Resources (GFAR) to undertake a study to investigate and provide recommendations as to how the adoption of zero-till (ZT) technology (particularly the Happy Seeder (HS)) could be accelerated in an effort to provide a viable option for farmers to cease the practice of burning crop stubble residues and in turn reduce human health impacts through reduced air pollution.

Key outcomes from this study is the development of this policy brief that provides recommendations for creating enabling environments that support the accelerated adoption of conservation agriculture sustainable intensification (CASI) technologies such as ZT through identifying innovative implementation pathways and enhanced value chains. A series of specific actionable recommendations are provided.

IMPENDING CHALLENGES

This Indo-Gangetic Plains (IGP) region is characterised by an intensive rice-wheat cropping system that represents a successful outcome of the green revolution. Farmers have readily adopted high yielding, short season varieties that when combined with high inputs, ready access to irrigation and tillage has resulted in regional food security. This success has come at a cost.

Increased intensification of cropping systems is leading to serious environmental concerns in relation to the long term impact on sustainability. The fragility of the farming environment is reflected in the impact of significant air pollution from the burning of crop residues, decreasing soil health (declining soil fertility and soil structure), increased weed and pest resistance (such as herbicide resistance in *Phalaris minor*) and declining water resources and water quality (through contamination from nitrate fertiliser, pesticide residues from excessive use). At the same time farmers are under immense pressure to maintain their livelihoods as increasing costs of production and a lack of market opportunities place them under financial hardship. Maintaining regional food and water security remains a significant challenge under the current environmental conditions that place long-term sustainability on a knife-edge.

RESEARCH APPROACH

Extensive field research studies involving on-farm adoption studies and a value chain analysis (linked to the supply and availability of ZT seed drills including the Happy Seeder) followed by a series of workshops engaging with stakeholder and senior policy makers provided the avenue for developing evidence based policy recommendations. In particular the study identified reasons why policy change is required, what policy changes would be effective, and how best relevant policy could be best implemented.

REGIONALLY SPECIFIC CHARACTERISTICS AND ISSUES

Cropping Systems in NW India (Haryana and Punjab)

Long-term sustainability of the intensive rice-wheat cropping systems are being questioned by farmers and agricultural experts. The impact of farmers burning rice straw residues prior to cultivating and sowing wheat is now recognised as a significant environmental problem, affecting all in the wider Indian community notwithstanding the serious air pollution problems in the nation's capital New Delhi. Despite the Happy Seeder being available commercially for more than 10 years as the only viable option to direct seeding cereal crops into standing crop stubble there is little farmer awareness of the technology. A lack of awareness and difficulty in accessing information combined with traditional farmer beliefs that crops can only be sown into well-tilled residue free seed beds serve as some of the major constraints to adoption of the HS and ZT seed drills.

Cropping Systems in the Eastern Gangetic Plains (Bihar and West Bengal)

Increased intensification of cropping systems across the Eastern Gangetic Plains (EGP) region is largely being achieved through the introduction of mechanisation in place of manual labour (that increasingly is becoming in short supply and more expensive). Whilst the manual harvesting of rice crops removes much of the straw (that is regarded as a highly valued animal feed source), an increasing trend towards the machine harvesting of crops is seeing a greater amount of stubble residue remaining in the field that is being burnt prior to the sowing of the next crop. Wheat straw residue levels (less valued as an animal feed source) are also increasingly being burnt in a trend triggered by the introduction of mechanical harvesting. The burning of rice straw residues is becoming an issue in western Bihar (in close proximity to the UP border region), as well as in the Malda district of West Bengal. As mechanical harvesting of rice crops becomes popularised it is anticipated that burning will become a much deeper concern. Availability of HS seeding equipment remains a challenge with poor sales and distribution networks, and very limited capacity in terms of machinery servicing, maintenance and operation.

Cropping Systems in Northern Bangladesh

Increased intensification of the cropping systems in northern Bangladesh is increasing as farmers aim to advance the intensity of their cropping systems even further. Whilst rice straw is a valued commodity for animal feed, like other surrounding regions it is expected that the burning of stubble residues will increase where the mechanical harvesting of crops increases. Agricultural mechanisation in the region is largely undertaken using two-wheeled tractors, and there has been a localised industry that provides the sales, servicing and maintenance support for the two wheel tractors. Implements designed and manufactured locally for the two wheel tractor include ZT seed drills. The smaller tractors are more affordable for the smallholder farmer and are well suited to fragmented land holdings comprising small plot sizes. The two-wheel tractors however require significant physical strength for the operator, placing the four wheel tractor at a more significant advantage and particularly suited for larger land holdings and/or for use in CHC operations.

Cropping Systems in Terai Region of Nepal

Increased intensification of cropping systems across the Terai region of southern Nepal has only in recent years become more of an accepted opportunity, however the benefits of such intensification is becoming apparent and has been clearly demonstrated through the SRFSI project and others. Increased mechanisation offers many advantages to village communities, however the opportunity to access tractors and ZT seed drills remains a significant challenge for most smallholder farmers. The establishment of CHC's at the farmer level presents a real opportunity to be capitalised upon as part of the out scaling initiatives associated with CASI systems development. Issues relating to the need to retain crop residues as part of a CASI system will require continued farmer awareness and education due to the conflicting practices between harvesting of straw for livestock production and the risk of stubble residues being burnt as stubble loadings post-harvest begin to build up as mechanised crop harvesting becomes more popularised throughout this region of Nepal. Availability of HS seeding equipment remains a challenge with poor sales and distribution networks, and very limited capacity in terms of machinery servicing, maintenance and operation.

THE OPPORTUNITY

Initiatives introduced to date across the Indo-Gangetic Plains (IGP) have successfully demonstrated the opportunity and potential for conservation agriculture sustainable intensification (CASI) technologies to significantly address cropping systems constraints. The development of Zero-Till (ZT) Seeding systems (using ZT seed drills including the 'Happy Seeder' (HS)) to sow crops without the need to burn or remove crop residues or cultivate the soil provides an opportunity to reverse traditional farming practices of burning crop residues and cultivation whilst at the same time significantly reducing crop establishment costs, improving irrigation efficiency and achieving similar if not higher crop yields.

Opportunities for the establishment of local service providers (Custom Hire Centres CHC's) that capture entrepreneurial spirit to assist in providing smallholder farmers with convenient access to the technology and locally adapted information are now available. Accelerating rapid adoption by farmers will not be realised unless the constraints to adoption, machinery technology and supply value chain inefficiencies (and impacts from the systems intensification associated with the green revolution) are addressed. Recommendations provided in this Policy Brief aim to support the development of an 'enabling environment' to assist in the accelerated adoption of ZT seeding systems in an innovation led farmer participatory driven environment.

POLICY INTERVENTION RECOMMENDATIONS

Consistent and long-term policies are required to achieve change and support the adoption of CASI technologies. The objective is to achieve scaled outcomes across the IGP, with all Governments needing to adopt a long-term planned approach towards providing an enabling environment for the adoption of ZT and HS seed drills. Demonstrated impact and benefits arising from policy

implementation needs to be integrated into all initiatives, through introducing simple monitoring tools to measure practice change and improvements in environmental sustainability, including the use of GIS and satellite monitoring tools. A 'scorecard approach' applied consistently across the IGP to measure impact and benefits is required to help demonstrate the success and returns to government, industry and farmer investment in CASI related technologies.

KEY RECOMMENDATIONS ARE PRESENTED

1 ZERO-BURN FROM ZERO-TILL Awareness Raising Campaign be Introduced

A lack of awareness and availability of information relating to CASI technologies (such as the Happy Seeder) amongst farmers across all regions served as a significant barrier to adoption. An awareness campaign, through introducing a marketing campaign 'ZERO-BURN FROM ZERO-TILL' is strongly recommended, featuring ZT and HS seeding systems. The environmental, agronomic and economic benefits of the system need to be highlighted, in addition to addressing common farmer misconceptions that a well-cultivated soil (often using a rotavator) that is also stubble and plant residue free is required to successfully achieve high yielding crops. Awareness raising through social media, traditional media avenues, billboard advertising and the appointment of local 'champion farmers' as local advocates of the technology should be considered.

RECOMMENDATION 1: A communication / awareness strategy incorporating innovative digital media approaches that support the adoption of CASI technologies (focusing on ZT and HS) be developed and implemented as a long-term opportunity to create positive motivation for on-farm adoption.

2 Innovation Platforms as an Inclusive Extension Vehicle for CASI be Expanded

The introduction of InP groups offers such a collaborative framework to reach common goals. InP groups have successfully motivated farmer participants to work more closely with the private sector, and to develop entrepreneurial skills as a means of gaining access to CASI technologies such as ZT in the EGP. Through utilising the skills and experience of local research and extension specialists supported by farmer advocates and stakeholders associated with the provision of CASI related services, technologies and inputs ZT technologies have been successfully introduced.

RECOMMENDATION 2: Expansion of the InP on-farm program from EGP be extended to other targeted regions as an immediate priority to support the introduction and implementation of CASI related technologies (focusing on ZT and HS), facilitated through KVK's and Farmer Producer Organisations (FPO's).

3 Building a More Effective ZT/HS Seed Drill Supply and Service Sector

Field studies concluded that there is an urgent need to improve the quality, supply and availability of ZT and HS seed drills to farmers (particularly in EGP), the need to provide additional instructions on machinery operation and use, and maintenance of such equipment (including the supply of spare parts). A series of initiatives supported by Government and manufacturers be developed as an immediate priority in order to ensure the successful introduction of such equipment and minimise dis-adoption.

RECOMMENDATION 3: Machinery manufacturers should be provided with support incentives to assist them in providing a larger network of retail agents, service centres and farmer training schools (focusing on the maintenance and operation of equipment) in addition to introducing random market place quality checks for equipment to help support the adoption of ZT and HS seed drills.

RECOMMENDATION 4: A collaborative platform be established with representatives from the highest level of Government, responsible ministries and the manufacturing sector to help ensure that long term relationships and the needs of the industry sector are clearly identified and supported to help improve and support the development of effective ZT/HS seed drill supply chains.

4 Re-orientation of Government Subsidies and Support Mechanisms are Required

The provision of subsidies for the purchase of machinery provided by government is in urgent need of review, from the perspective of ensuring that funds directed towards incentivising adoption is maximised in a non-discriminatory manner in an environment of increasing public scrutiny. Subsidies provided to rotavators that reinforces poor farming practices needs cease immediately.

RECOMMENDATION 5: A re-orientation of mechanisms that currently provide direct subsidies for machinery purchase be reviewed and alternative models of support directed towards a range of options such as the removal of Government GST on machinery, providing access to affordable finance (consideration towards interest rate subsidies for both manufacturers and purchasers of equipment) in addition to developing business planning skills for custom hire centre operators be explored.

5 Concerted Effort to Support the Establishment of Sustainable Business Models for Custom Hire Centres (CHC's)

CHC's provide the opportunity for smallholder farmers to access ZT and HS seeding services that are easily expandable to include other technologies that support the development of CASI farming systems, cost-effective cropping inputs, marketing platforms, training and capacity building services. Once established and when linked to local Innovation Platform Groups, CHC's are driven by the entrepreneurial spirits of local community based operators who provide locally adaptable services and advice to farmers that in turn builds local capacity in relation to CASI systems. The development of Custom Hiring Centres (CHC) at district level is considered to be one of the best ways to achieve widespread adoption and out-scaling of technologies that is affordable and accessible by all farmers regardless of farm size. Proper functioning CHC's need to focus on providing convenient and affordable access to machinery for all farmers including smallholder farming women, and serve as the gateway to introducing sustainable and profitable conservation agriculture based systems to all farmers.

RECOMMENDATION 6: It is strongly recommended that a specific project team and support service be established that would provide a range of support services for the establishment of CHC's, including business and financial planning and governance support, business leadership, technical training (conservation agriculture equipment and CASI systems approaches).

6 Formation of a Regional Collaborative Platform (RCP) for the IGP Region

Establishing a RCP for the IGP region (comprising country representation from Pakistan, Nepal, India and Bangladesh) as a central platform for supporting the out scaling of CASI technologies, the sharing and dissemination of technical research and extension experiences, knowledge and resources is critical to addressing the regional challenges associated with ensuring widespread adoption of CASI, and active engagement and participation by all stakeholders in particular the private sector, farming women and other marginalised stakeholders. RCP membership should include: Principal Agricultural Secretaries at national/state levels; private sector representatives (manufacturers, input suppliers, finance sector), research (national and international), farmer/CHC representatives, and women's groups.

RECOMMENDATION 7: A Regional Collaborative Platform comprising representatives from the highest level of Government (Agricultural Ministry; research, extension and policy related) be established for the IGP region (comprising country representation from Pakistan, Nepal, India and Bangladesh) as a central platform for supporting the development of supporting government policy and the out scaling of CASI technologies through sharing and dissemination of information, knowledge and training resources, on-farm validation of best management CASI practices, training and capacity building.

KEY RECOMMENDATIONS REVIEW

1. ZERO-BURN FROM ZERO-TILL Awareness Raising Campaign be Introduced

2. Innovation Platforms as an Inclusive Extension Vehicle for CASI be Expanded

3. Building a More Effective ZT/HS Seed Drill Supply and Service Sector

4. Re-orientation of Government Subsidies and Support Mechanisms are Required

5. Concerted Effort to Support the Establishment of Sustainable Business Models for Custom Hire Centres (CHC's)

6. Formation of a Regional Collaborative Platform (RCP) for the IGP Region