

TECHNICAL BULLETIN

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Improvement of Soil Fertility and Crop Productivity through Nutrient Management and Conservation Agriculture

Increasing agricultural production to enhance and maintain food security is a great challenge in densely populated, land hungry Bangladesh. This necessitates increasing the cropping intensity (195% at present) with suitable cropping patterns and appropriate soil health management in a

conservation agriculture (CA) system comprising minimum tillage, crop residue recycling and proper nutrient management. Intensive cropping demands timely and appropriate tillage operations to fit each crop into the optimum sowing and harvest times. It involves peak periods in the crop calendar with high labor demands, when machines like the power tiller (PT) drawn versatile multiple planter (VMP) can be a handy and useful tool for crop establishment and crop residue management. Farm mechanization is a priority area as set in the National



PT-VMP combine in operation

Agricultural Policy (NAP). The CA-efficient nutrient management approach needs to be tested and adopted at farm levels across AEZs of the country.

The Department of Soil Science, BAU, Mymensingh implemented a project for three years, which was designed to test CA with soil test based (STB) nutrient management and inclusion of Mustard in between two rice crops, i.e., transplanted Aman (T. Aman) rice and Boro rice. The main objectives were to (i) improve/maintain soil fertility in intensive cropping systems through nutrient management and CA practice, (ii) increase crop yields and cropping system productivity of intensive cropping patterns.

Methodology

Field trials were conducted at the BAU research farm and in farmers' fields in Muktagacha and Dhanbari upazilas of Mymensingh district. In each upazila, there were 3 blocks, each measuring 330 decimals with 7-10 participating farmers. Each block was divided into two sub-blocks to represent strip tillage (ST) and conventional tillage (CT). Strip tillage was done



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by VMP fitted to a power tiller. Practically, it made a furrow and along the furrows, rice seedlings (4-week old) were manually transplanted and mustard seeds were sown and covered with soil. About 30% crop residues (by height) were retained in the fields of the ST sub-blocks and 15% in case of CT (farmers' practice). T. Aman rice (BRRI dhan49) was grown during the period from the 2nd week of July to the 4th week of October and thereafter Mustard (BARI Sarisha14) was grown during the 1st week of November to the 1st week of February. Then, Boro rice (BRRI dhan28) was grown in the plots during the 2nd week of February to the 2nd week of May. Recommended rates (STB basis) of N, P, K, S, Zn and B were applied for the CA trials. Weeds were controlled by applying herbicides, 'Round Up' before sowing or transplanting and 'Superhit' one week after rice transplanting.

Results and Outputs

The CA practice along with STB fertilizers increased system productivity (rice equivalent yield) by 14%, reduced the cost of production by 12%, increased the net income by Tk. 19,254/ha/yr and the BCR by 27% compared with farmers' practice (CT). The soil organic matter and nitrogen contents increased by 16% in the T. Aman- Mustard-Boro pattern.



The wheat-mungbean-T. Aman cropping pattern under conservation agriculture

Rice equivalent yields (REY) in the T. Aman-Mustard-Boro cropping pattern as influenced by tillage practices

Location	Tillage practice	REY (t ha ⁻¹)	Total gross income (Tk./ha/yr)	Total variable cost (Tk./ha/yr)	Net annual income (Tk./ha/yr)	BCR
Muktagacha upazila						
Kuripara	CA	13.73±0.44	86751	63717	23034	1.36
	FP	12.15±0.94	84282	73366	10916	1.15
Dulla	CA	14.07±0.36	95282	63122	32160	1.51
	FP	11.97±1.08	83812	72389	11423	1.16
Kathalia	CA	14.15±0.52	88552	64365	24187	1.38
	FP	12.21± 0.51	85950	72491	13469	1.19
Dhanbari upazila						
Baghil	CA	14.11±0.66	93739	63744	30049	1.47
	FP	12.20±0.26	79172	72197	6974	1.10
Samatkur	CA	13.80±0.36	95214	63741	31473	1.49
	FP	12.11±0.29	83147	72147	10999	1.15
Baldiata	CA	14.06±0.69	100380	64898	35482	1.55
	FP	12.71±0.35	81064	73990	7075	1.10

The research project clearly demonstrated CA, i.e., minimum tillage with crop residue recycling and proper soil fertilization would be an agro-economically viable option for intensive rice based cropping patterns to enhance soil organic matter, system productivity and farmers' incomes.

Recommendations

- ❖ Minimum tillage (single pass) with 30% (by height) crop residue retention should be practiced for increasing crop productivity and maintaining soil fertility.
- ❖ Mustard can be grown in between two rice crops. Short-duration T. Aman rice varieties (e.g. BRRI dhan49, Binadhan-7) should be grown.
- ❖ Balanced application of fertilizers is needed.
- ❖ Future research should include studies on the carbon foot print and greenhouse gas emissions.
- ❖ Long-term monitoring of soil physical properties, pH and potassium level in relation to CA practice needs to be done.

This technical bulletin has been prepared on the basis of technical information available from a completed CGP project of KGF, the details of which are given below:

Project Code and Title: TF 15-SF/15. Improvement of soil fertility and crop productivity through nutrient management and conservation agriculture in a triple cropping pattern

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