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Improving and Intensifying Cropping Systems in the Coastal Saline Zone

Scarcity of non-saline irrigation water and high soil salinity during the dry winter season are the major problems of crop production in coastal region of Bangladesh (Fig. 1). Fallow-T. Aman-Fallow is the dominant cropping pattern in the Khulna, Bagerhat and Satkhira districts of this region. Generally farmers cultivate local varieties of T. Aman rice with a low yield (1.5-2.0 t/ha) and a long duration (165-185 d) which results in late harvest. In some areas winter crops, such as wheat, potato and vegetables are grown by farmers and some farmers grow sesame in small areas in late Rabi to increase their farm productivity.

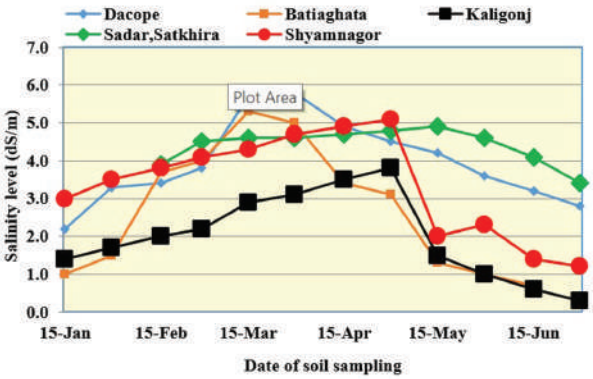

Fig. 1. Soil salinity levels in farmers' fields at different times of the years in Satkhira and Khulna districts

Some shrimp 'ghers' (shrimp ponds) can be utilized for vegetable cultivation in the dry winter season. For improving the food and nutrition security situation in this region it is imperative that the conventional cultivation practices and methods be replaced by environment-friendly and socio-economically beneficial ones. There is an ample opportunity to adopt a T. Aman-Rabi-Fallow/Kharif-I cropping system as a technology to increase cropping intensity in the salinity affected southwestern region by improving cropping systems with the introduction of new crops like pulses, oil seeds, vegetables, spices, etc., using salt tolerant varieties, growing crops on raised beds, mulching, rainwater harvesting in 'kunni' (mini pond) or canal for irrigation. In view of these possibilities, this project was initiated to study and demonstrate the T. Aman-Rabi-Fallow/Kahrif-I cropping pattern with the use of appropriate varieties and improved technologies of crop establishment, residual soil moisture use and irrigation in the southwestern coastal districts.

In view of these possibilities, this KGF sponsored project studied and demonstrated the T. Aman-Rabi-Fallow/Kharif-I cropping pattern with the use of appropriate varieties and improved technologies of crop establishment, residual soil moisture use and irrigation in farmers' fields of the southwestern coastal saline zone of Bangladesh. The specific objectives were to improve/develop economically viable cropping systems, adopt developed cropping patterns and increase the cropping intensity, and productivity and profitability of the cropping systems in the coastal saline areas.

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Methodology

Fig. 2. Introducing water melon into the cropping system in coastal saline areas

Base line surveys on local crop production practices and agro-economic issues were completed early in the project implementation. The project locations were farmers' fields in Dacope, Batiaghata and Dumuria upazilas of Khulna district and Shyamnagar, Kaliganj and Sadar upazilas of Sathkhira district. Eleven BARI developed salt-tolerant varieties of Rabi crops namely mustard, grass pea, wheat, potato, maize, garden pea, bitter gourd, sweet gourd, bottle gourd, watermelon (Fig. 2) and sunflower and two Kharif crops namely mungbean and sesame were grown in 123 farmers' fields (24.51 ha) in the project area using relay, zero tillage, dibbling and mulching techniques. BRRI developed short duration T. Aman rice variety, BRRI dhan75, was cultivated in 16.51 ha of land replacing long-duration local T. Aman varieties. Various combinations of crops (Fig. 3) were tried in several improved cropping patterns in the project areas in two consecutive years. The electrical conductivity (EC) of soil in each plot was monitored at regular intervals during crop growth starting from sowing/transplanting to maturity.

Fig. 3. Crops in a T. Aman (var. BRRI dhan75)-Potato(var. BARI Alu-8)-Mungbean (var. BARI Mung-6) cropping pattern tested in a saline farmers' field in Dacope upazila, Khulna

Results and Outputs

By introducing short-duration T. Aman rice and Rabi crops including wheat, maize, pulses, oilseeds and vegetables, 19 different two or three crop based improved cropping patterns were developed for the saline coastal areas to replace the traditional single or occasionally two crop based cropping pattern. About 320 farmers were trained on modern production technologies for the selected 19 cropping patterns. Potato and mungbean were the two major crops following T. Aman rice as components of the improved cropping patterns. Potato was a component crop in 10 test cropping patterns.

These new cropping patterns outperformed local farmers' practice of the T. Aman-fallow-fallow yearly cropping in terms of rice equivalent yield (REY) and economic indices, i.e., gross return, gross margin, and marginal benefit cost ratio (MBCR) and overall farmers' incomes and benefits. Table 1 shows the average performances of a few of these improved cropping patterns across the project locations.

Across the project locations and cropping patterns, T. Aman rice yield varied narrowly from 4.43 to 4.88 t/ha compared with 4.62 t/ha in farmers' monocrop practice., Potato yield varying within the narrow range of 22.7 to 26.9 t/ha while mungbean was a component in 9 cropping patterns and its yield, except at one location where it failed, varied from 0.6 to 0.9 t/ha. The

Table 1. Economic returns, land use efficiencies and sustainability indices of different cropping patterns tested in coastal saline areas (means of 2018-19 and 2019-20)

Cropping pattern	Gross margin (Tk/ha)	Production efficiency (kg/ha/day)	Systems profitability (Tk/ha/day	Land use efficiency (%)	Sustainable yield index (%)	Income increase over FP (%)
T. Aman-potato-sesame	183318	84	502	64.38	52.51	80
T. Aman-potato-mungbean	134255	71	368	70.68	47.07	73
T. Aman-maize-mungbean	91575	52	251	56.99	19.54	61
T. Aman-mustard-mungbean	63420	41	174	64.25	15.45	43
T. Aman-grasspea-mungbean	65800	44	180	45.89	6.90	45
T. Aman-fallow-watermelon	416825	148	1142	50.14	79.81	91
T. Aman-fallow-bitter gourd	144875	75	397	49.32	29.46	75
T. Aman-fallow-bottlegourd	131325	67	360	50.41	24.96	73
Farmers' practice (FP)	36103	40	99	31.51	-3.16	-

highest total rice equivalent yield (TREY) of 27.13 t/ha was obtained from the pattern T. Aman-fallow-watermelon which was six times higher than the meager 4.62 t/ha from a single crop of T. Aman rice in the farmers' practice (FP). The inclusion of potato in the cropping pattern increased cropping intensity and the TREY from these patterns was also relatively high, 16 to 20 t/ha. The rice equivalent yield and income were increased by 60-83% and 65-92%, respectively across the project locations.

Expected Impact

- Cropping intensity will be increased in in the coastal region where cropping intensity has so far remained relatively compared with that in the favorable ecosystems of the country
- Land productivity in the coastal saline areas will increase
- Farmers' incomes will be enhanced resulting in the improvement of the socio-economic conditions of the local farmers
- Contributions to the national agricultural GDP of the country from the southern part of the country will increase.

Recommendations

- A new cropping pattern, T. Aman-potato-mungbean/sesame with zero-tillage potato cultivation should be disseminated through block demonstrations/piloting in coastal saline areas namely, Dacope, Batiaghata, Dumuria, Koyra of Khulna and Kaliganj, Shyamnagar of Satkhira
- The cropping pattern T. Aman-mustard-mungbean/sesame with zero-tillage mustard cultivation needs to be demonstrated to farmers of the Batiaghata, Dumuria (Khulna) and Kaliganj (Satkhira)
- The patterns T. Aman-fallow-bottle gourd, T. Aman-fallow-bitter gourd, T. Aman-fallow-sweet gourd and T. Aman-fallow-watermelon need to be promoted as agro-economically highly remunerative cropping patterns in the Dacope, Batiaghata, Dumuria, Koyra, Kaliganj and Shyamnagar upzilas.

This Technical Bulletin has been prepared on the basis of technical information available from a completed BKGET-KGF Funded CGP Project, the details of which are given below:

Project Code and Title: TF 54-SBR/17. Improvement of Cropping Systems Applying Different Agronomic Management Practices in Salinity Affected Coastal Zone of South-western part of Bangladesh for Attaining Food Security and Sustainability

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