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Strategies for Improving Productivity of Rice, Wheat, Maize, Sugarcane and Cotton

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Abstract

The target of doubling farmers' income in a short period requires identification of sources of income growth and enabling conditions for harnessing their growth potential. Agriculture is the main source of farmers' income in India; therefore, technological and institutional policy options for making agriculture a remunerative enterprise are suggested. Huge gaps exist between realized and potential yields of most crops that can be bridged to a large extent by enhancing farmers' access to key inputs, irrigation, markets, and credit and extension services. However, extreme price volatility acts as disincentive to adopt productivity enhancing technologies. Post-harvest management and small scale processing would help the farmers to capture benefits of value addition. Effective coordination between centre and states is important in mainstreaming and channelizing policies and investment to achieve the target of doubling farmers' income.

Introduction

Owing to several biotic and abiotic stresses, the agrarian distress in India has accentuated in recent years and to this problem, Indian government in its annual budget of 2016-17 set a target of doubling farmers' income by 2022-23, and initiated a number of steps, such as improving irrigation efficiency, providing crop insurance, improving market infrastructure and its efficiency, promoting organic farming, restoring soil health and so on. It needs to be ensured that the mission of DFI moves in right direction and is accomplished within the stipulated period and also it is important that accurate information on key indicators of agricultural performance is generated and made available to policymakers and other stakeholders for their effective monitoring and corrective actions. The pathway for DFI encompasses several dimensions, from production to post-harvest management including bridging yield gap, crop diversification, improvements in total factor productivity and proper management of irrigation along with the provision of market and institutional support for efficient post-harvest management (Saxena and Chand, 2017; Government of India, 2015). There are considerable yield gaps in various crops like rice, wheat, maize, sugarcane, cotton *etc*. If the yield gaps are bridged through proper technological and scientific interventions, a lot of agricultural output can be saved. The agricultural prices in recent past have witnessed extreme volatility that needs to be addressed through proper market information and intelligence efforts. Besides, effective post-harvest management and small scale food processing at household-level would facilitate growth in farmers' income. There is a need to prioritize areas for investment based on their potential to contribute to the targeted growth and productivity, and both the public and private sectors should

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work in tandem to achieve the goal of doubling farmers' income.

Rice

• Promote cultivation of latest high yielding varieties and hybrids to achieve seed replacement rate (SRR) of 80% in HYVs and 100% in hybrids and to increase the productivity substantively.

• Promote bio-fortified high nutrient rich varieties with high contents of iron and zinc.

• Identify the rice varieties that are in demand in export market and accordingly promote special varieties like high yielding basmati, aromatic non-basmati varieties and sticky rice to capture higher share in global market.

• Promote water use efficient rice varieties, technologies and practices, preferably using micro-irrigation system.

• Adopt establishment techniques like unpuddled transplanted rice, zero tillage transplanted rice and zero tillage direct seeded rice.

• Large scale result demonstrations undertaken by extension machinery and KVKs will help in promoting adoption of these modern technologies.

• Quality and judicious use of inputs such as water, seeds, fertilizers and pesticides with efficient use of modern technology are needed.

• Crop substitution by diversification is need of the hour in Indo Gangetic Plains and uplands of eastern Indian states.

• Substitution strategy must follow substantive increase in productivity in remaining areas, so that food security is not compromised; hence, any substitution plan must be accompanied by a comprehensive strategy to realise higher yields in remaining area under rice.

Wheat

• In context of climate change like rising temperatures and rainfall deviations, develop and promote the varieties of wheat tolerant to heat and moisture stress in different growing regions.

• Due to large consumption base, the bio-fortified varieties should be promoted to assure nutritional security.

• Producers must be knowledgeable and experienced through training programmes on modern production technologies, complete package of practices and management of soil health.

• There is need for priority attention to ensure adequate availability of quality seeds and inputs.

• Farmers must be updated about impact of climate change on cultivation and coping strategies to mitigate it.

• Encourage short duration varieties enabling raising of summer crops, wherever irrigation source is easily accessible.

• Validation of scientific technologies like conservation agriculture, ridge and furrow irrigation system, bio-fertilizers and drip irrigation, secondary and micro-nutrients, soil amendments, climate resilient varieties realizes increased income at various magnitudes by reducing the cost of resources.

• Durum wheat has led to additional earnings due to excess demand for grains for export purpose and manufacture of diverse products; however, it has been under cultivation only in certain pockets of India, especially in Central and Peninsular zones and it may also be promoted in other zones.

• Another old species, dicoccum/ emmer wheat with its low glycaemic index and high nutrient values, is known as a health food, particularly for diabetic patients and grown in south peninsular zone and some parts of western India; hence, it should be encouraged by adopting HYVs and branded as premium product in both domestic and export markets.

• As long term strategy, R&D should focus on evolving heat tolerant varieties, besides working on appropriate package of management practices to counter the probable negative impact of temperature rise on productivity.

• Diversification of rice-wheat cropping system under conservation agriculture in Indo Gangetic plain is the key to sustainability.

• Diversified cropping systems including pigeon pea-wheat, maize-wheat, and adoption of pulses in predominating cropping systems are examples of sustainable crop production.

Maize

• A critical key to realize higher yields lies in promoting single cross hybrids (SCHs).

• Tamil Nadu and Bihar have registered higher productivity in the recent years by bringing 100% of maize areas under SCHs.

• SCHs should also be promoted in other states using a suitable mechanism.

• Promote maize not only for human consumption but also for poultry, dairy and industrial sectors.

• Maize being amenable to large number of industrial intermediate and final products, its production may be integrated into appropriate value chain.

• Being day neutral and climate resilient crop with high yield potential, it can be promoted as an all season crop.

• Wherever rice-wheat cropping system can be changed without impacting food security, adopt maize as replacement crop, for rice in *kharif* and for wheat in winter and spring.

• Several dairy farmers in Punjab have mechanized maize

based silage; besides, other states may replicate the protocol and technique to suit the needs of their dairy farms.

• Bringing maize into organized use in dairy sector promotes efforts in productivity enhancement at farm level.

• Develop climate resilient germplasm and hybrids.

• Breeding programmes can be reoriented to engineer maize germplasm resistant to biotic and abiotic stresses.

• Strengthen production of baby corn, sweet corn, wax corn, pop corn, quality protein maize and other specialty corns in hinterlands, along with establishment of suitable processing industries.

• Specialty corns are good for diversification and value addition besides supporting livestock feed industries.

Sugarcane

• A package of approaches based on R&D, technology adoption at farmers' level and financial support can help in enhancing yield potential.

• High cost of cultivation is a cause of concern as it is both labour and input intensive; hence, two of the major interventions to reduce the COC include micro irrigation and mechanisation.

• Policy adoption of compulsory micro irrigation by Maharashtra Government should be replicated across India.

• Farm mechanisation can flourish by promoting custom hiring centres, farm service contracts etc.

• Greater emphasis is required on technology transfer and management practices to farmers.

• The upgradation should happen from 'Sugar factory' to 'Bio-energy factory' to 'Agro-processing complexes', so that maximum revenue is captured.

• Government may examine to permit the production of ethanol from B-heavy/ B-grade molasses and also straightway from sugarcane juice, in comparison to C-grade molasses.

• It should be stabilized by fixing appropriate prices and adopting a consistent policy regime by the Government.

• Even when sugar is produced, it should not be for purpose of sweetener alone, but also be produced to utilize as feedstock for several feasible industrial products.

• Sugarcane should be promoted as a use specific crop like sugar, ethanol, alcohol etc. and therefore the right variety should be promoted.

Cotton

• Productivity has reached a plateau over last five years which must be broken by multiple abiotic/biotic stresses resistant varieties.

• ICAR-AICRP has developed and released more than 300 varieties and hybrids for different growing tracts.

• Based on local conditions, suitable varieties and hybrids may be identified and promoted because indiscrete choice may introduce variations in fibre length, strength, Micronaire, *etc*. and dilute the quality of supply to cotton mills imposing an impact on valuation and price.

• State Agricultural Universities should undertake field trials and recommend the most suited varieties for local agro-climatic regions.

• Take advantage of one of the world's largest gene bank for cotton available in India with accessions of all the four cultivated species offering an opportunity to breed new varieties and hybrids to combat multiple challenges, including climate change uncertainties.

• Promote high density planting system as it is helpful in enhancing yields, particularly in low fertility fields.

• Cotton, being a long duration and wide spaced crop, provides ample scope for weed infestation; therefore, broad spectrum and cheaper post emergence chemicals and also intercropping should be advisable for weed management.

• Promote varieties resistant to sap sucking pests, which provide a robust foundation for IPM coupled with appropriate seed treatment to enhance productivity and do away with the need for pesticide application for first two to three months after sowing.

• Adopt sub-soiling technique at 40-45 cm depth to break hard pan, a major problem in many regions impeding root penetration.

• Bt cotton hybrids have helped to achieve higher yields, since their introduction in India in 2002.

• Promote Bt cotton varieties suitable to rainfed regions and low growing seasons.

• Promote high density planting system to take benefit from low cost of production.

• Productivity can be improved through efficient and optimal use of farm inputs, including water and nutrients which also the yield plateau in Bt cotton.

• Drip irrigation should be promoted on large scale, along with fertigation and mulching.

• Cotton requires an average of 240 man days from planting to picking making it highly labour intensive and since labour is not always available in time, besides being costly, field operations are adversely affected translating into poor productivity. Hence, aggressively promote farm mechanisation, by identifying cotton specific machineries including cotton picker.

• Diploid cotton is a natural source for overcoming biotic and abiotic stresses and can be grown on marginal lands.

• High productivity at farmers' level is facilitated by suitable technologies.

• Address the structural weaknesses through contract farming to rationalize COC, market intelligence and improved research activities.

Conclusion

By the end of 2022-23, achieving a target of total rice output of 124 million tonnes and wheat productivity of 119 million tonnes is an important aspect of ensuring food security. There is a need for focused attention on yield upgradation to reach an average of at least 4 tons/ha by 2022-23. Sugarcane is cultivated as cash crop; therefore, approach to income enhancement of farmers lies in increasing per hectare yield and sugar recovery with no further increase in cost of cultivation. In order to double the income of farmers by 2022-23, a target should be set for an increase in average yield from 71 t/ha in 2016-17 to 79 t/ha in 2022-23 and average sugar recovery from the current average of 10.6% in 2016-17 to a minimum average of 11% in 2022-23. The technical and economic potential of the crop is as high as 339 t/ha and the current realised average yield is as low as 21% of the potential. The current level of income from cotton cultivation is very low and showing negative trend due to increased cost of cultivation coupled with stagnant productivity. To achieve the targeted income by the year 2022, it is necessary to limit the production costs and increase the productivity by utilizing all possible means.

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