

Agriculture

The Problem

The Union Government is aiming to double farmer incomes by 2022, in this context it is necessary to review existing agricultural policies, and in particular to evaluate strategies related to productivity enhancement which may provide pathways to improving incomes. To sustain a high growth rate in agriculture it is important to address major risks and challenges that the agriculture sector faces.

About 65 per cent population of Rajasthan is dependent on agriculture and allied activities for their livelihood (Swain 2012). There exists a large variation in food grain production across states, and very high risks are involved in food grain production in the state of Rajasthan (Chand and Raju, 2009). Reducing instability in agricultural production has been a major policy concern for several years. With the objective of doubling of farmer incomes, the Government of Rajasthan is focusing on increasing the seed replacement rate, enhancing crop productivity through improved soil health, crop diversification towards high value commodities, and strengthening the extension system, along with improved livestock-based systems.

Solutions

Interventions	BCR	Benefit (INR Crores)	Cost (INR Crores)
Certified Seed Production & Promotion	20	11,586	584
Improving / Expanding Extension Services via ICT	3.6	6,862	1,899
Soil Health Cards	1.1	2,601	2,406
Crop Diversification	1.0	4,176	4,074

All figures assume a 5 percent discount rate.

The full paper by agricultural economist Dr **Surabhi Mittal**, Independent Consultant and Non-Resident Fellow, Tata-Cornell Institute for Agriculture & Nutrition (TCI), Technical Assistance and Research for India Nutrition & Agriculture (TARINA) is available on www.rajasthanpriorities.com/agriculture-and-food-security.

Certified Seed Production and Promotion

The Problem

Improved crop productivity is an important strategy to increase farmer incomes Govt. of Rajasthan (2017). Seed is one of the crucial inputs that help to improve productivity. The seed replacement rates and varietal replacement are low for most of the crops in the state of Rajasthan.

An extremely low seed replacement rate (SRR) remains one of the hindrances to introducing high yielding varieties. In India, in general farm saved seed (FSS) is the most prominent source of seed for

staple crops. More than 70 percent seed usage, particularly for food crops, is through FSS resulting in very low SRRs.

The Solution

There is a need to encourage farmers to adopt the outcomes of research on seed technology through certified seed production so that these can contribute to gains for the farmers as seed replacement rates improve.

National Seed Policy 2002 emphasizes the need to enhance the SRR of various crops to achieve the food production targets of the future. The policy document also shows that there are huge yield gaps

and one of the reasons for this is the low seed replacement rate.

The aim of this intervention is to increase the availability of certified seeds for major crops in the state to improve the SRR which would result in producing higher yields. To enable this, the Rajasthan State Seeds Corporation has geared up to enhance the processing, storage and marketing capacity for next five years.

Costs

The costs include two components. First is the cost of production of the additional seed required (all the major crops in Rajasthan) to achieve the higher SRR.

Higher SRR is achieved over a three year period through this intervention, by expanding extension, demonstration and field days, so that more farmers can adopt the modern seed varieties. The second cost component of this intervention is the cost of promotion to increase the adoption of the improved seed. This is primarily the additional extension cost that is required for the increase in land under cultivation under modern varieties. This cost is Rs 186 per hectare.

The total cost of this intervention is estimated to be Rs. 584 crores.

Benefits

The benefit from this intervention is mainly the increased yields because of the use of certified seed. The higher yields lead to increased production and thus higher incomes. The income gain to farmers is the total benefit. Yield gains of 10% is assumed.

Total benefits of this intervention are estimated at Rs. 11,586 crores.

Crop Diversification

The Problem

The agriculture sector is still largely based on a system of monocropping and is driven mainly by staples such as rice and wheat. This lack of diversification leads to greater risks of poor yields and crop failure. Given the current threat from climate change, crop diversification would act as a risk mitigation strategy for the farmers.

The Solution

Diversification in general is defined as moving from monocropping to multiple cropping or moving away from traditional cropping systems to high value crops. Crop diversification provides a common solution for income and resource sustainability, especially relevant in the present time when climate variability adds to the risk of crop failure. The aim of this intervention is to encourage crop diversification.

Rajasthan government also proposes crop diversification as a part of their strategy to double farmer incomes by 2022 (GoR, 2017, Swain, 2012; GoR, 2013).

Costs

Crop diversification interventions account for changing cropping patterns, both in terms of a shift in area between crops and increased crop intensification. It is assumed that extension activities will accelerate the trend of crop diversification efforts by 10% which are changing towards higher value crops. The calculations for the costs are based on the change in area, and the percentage annual change in area between 2011-17.

The primary driver of cost is the expansion in effective cropping area, brought about increased cropping intensity. The benefit-cost ratio therefore estimates the efficiency of increasing production at the extensive margin.

It is estimated that in one year, the area under production for the state would increase by 5.8% from 17.6m ha to 18.6m ha. The total cost of production in this time would increase by 3,827 crore, or an increase of 6.1%. This is the weighted average of thirty major crops grown in Rajasthan.

The second component of the cost is the cost of extension services. It is assumed that per hectare cost of extension would be Rs. 186. This amounts to Rs 451 crore per year for the entire state of Rajasthan.

Total cost of this intervention is estimated at Rs. 4,074 crores.

Benefits

The total change in value of agricultural produce at the wholesale prices of individual crops is used to compute the net benefit to the state resulting from crop diversification.

The second benefit is environmental gains because of diversifying away from high water consuming crops. For this study analysis of cotton and soybean is taken as they are high on water footprint. The value of water savings is taken as Rs 8 per m³ i.e. Rs. 8 per 1000L and the total benefits are 76 crore.

Total benefits estimated for this intervention is Rs. 4,176 crores.

Soil Health Cards

The Problem

In India, the current consumption of NPK (nitrogen, phosphorus, potassium) as a ratio is 6.7:2.4:1, which is highly skewed towards nitrogen, as against the ideal ratio of 4:2:1 (Reddy, 2017). Balanced use of fertilizers is needed, and to support this the Government of India introduced the Soil Health Card Scheme across India (Gol, 2017, Yadav et al., 1998)

The Solution

Proper maintenance of soil health is necessary to protect the capacity of the soil to ensure higher crop productivity. Soil Health Cards is one way to ensure optimal doses of fertilizers and cropping patterns, in line with scientific recommendations.

The intervention proposes to develop modalities for soil sample collection along with standard sampling norms, quality control in the soil analysis, training of sampling staff and lab personnel, intensive use of ICT for database management for faster delivery of Soil Health Cards in PPP mode and popularizing soil testing based integrated nutrient management practices through field demonstrations/field days. Better soil health helps reduce the cost of production and improve yields.

Costs

The cost of the Soil Health Card (Rs 190 per sample estimated at Rs. 22 crores per year), training for soil analysts, financial assistance for the package of nutrient recommendations, capacity building of farmers and experts, regular monitoring and evaluation costs, and the cost of managing the mission. This is built up over the three years.

The total number of soil samples considered for the cost analysis are as per the targets of cycle 2 for

Rajasthan, which is 11.54 lakhs. This target is repeated every year and it accounts for 46 percent of households in the state per year. The largest cost is for assistance provided to farmers for micronutrients to rejuvenate soil conditions.

The total cost of this intervention is estimated at Rs. 2,406 crores.

Benefits

The Rajasthan government's plan of action includes covering at least one third of the state every year. The benefits of using soil health cards are usually experienced in the third year.

The main benefit from the adoption of SHC is the reduced cost of fertilizer and manure because of improved efficiency, where improved soil health leads to yield gains.

The total benefits of this intervention are estimated at Rs. 2,601 crores.

Improving/Expanding Extension Services via ICT

The Problem

The extension services in India had primarily been the responsibility of the public sector. Public sector extension services are usually criticized for their ineffective targeting, poor reach and the huge administrative cost of delivering information (Mittal, 2012).

The Solution

Extension services play a crucial role in supporting overall agricultural activities by taking the research, the technology and the know-how to the farmers. The World Development Report 2008 (Jock R. Anderson (2007) emphasized that agricultural extension plays a key role in agricultural development and in promoting sustainable, inclusive and pro-poor economic development. This intervention seeks to rely on ICT for improving the existing extension services.

During the past few years, with the increase in mobile penetration even in rural areas, there has been an evolution of ICT-based extension services models to disseminate agriculture related information. The overall goal of using the mobile

phone-enabled information delivery mechanism is to have inclusive growth by reducing the knowledge gap between large and small farmers and by creating awareness.

Costs

The model assess what would be the cost of reaching all farmers who have access to mobile phones over a period of 5 years with advisory services and what is the potential benefit of utilizing these services.

The costs is a sum of three components. 1) cost of delivering agricultural advisories through SMS 2) Cost of IVRS (Integrated Voice Recording Service) 3) Other costs of operations. Since agriculture is an activity throughout the year, the assumption of 200 SMS per year at the rate of Rs. 1 per SMS is added as a cost. Based on estimates of running the mobile phone based advisory service, the operational cost is taken as \$0.83 per household per month.

The total costs of the intervention are 1889 crore over five years.

Benefits

The main benefit of improved extension services is increased farmer incomes. It is estimated that

households that had access to ICT based advisories have 16 percent higher profits than the control group (Cole and Fernando 2014).

Considering the utilization rates of mobile based advisory services, the study build up the intervention over the 5 year period with users at 20 percent in year 1, 40 percent in year 2, and up to 60 percent by year 5.

Total benefits of this intervention are estimated at Rs. 6,862 crores.

Pay-back on agricultural interventions

