Yield gap analysis of cotton in Bhadradri kothagudem district of Telangana

ABSTRACT

Cotton (Gossypium spp.), also known as the "white gold" or "king of fibres," is inextricably linked to human civilisation. It has a significant impact on India's economy. In the years 2019-2020, an investigation was conducted in the Bhadradri kothagudem area of Telangana. Inputs, cost and returns, and production data were collected from 120 cotton growers via personal interviews. The whole yield difference was predicted to be 21.69 percent. It was discovered that the total yield gap varied with the size of land holdings and that the size of land holdings and the total yield gap had an inverse connection. This hypothesis states that as the size of a land holding grows, the total yield gap shrinks. The reasons driving the yield gap in cotton have to be identified in order to narrow the yield gap. The gap between the suggested levels of all critical inputs at progressive farmers plot and actual input use levels was determined to be a primary driver for vast variances in realising the potential farm production on sample farms, according to the functional analysis of the yield gap in cotton. The data can be used to form conclusions about how to reduce the yield gap-II by using recommended levels of key inputs.

Key words: *Cotton, Yield gap, progressive farmers, potential farm yield, human civilization, Indian economy*

INTRODUCTION

Cotton is India's most important commercial crop, influencing the country's economy by providing a source of revenue and employment for the majority of the population. In terms of area under cultivation, India has the largest proportion in the world, with roughly 8 million hectares (36 %). Cotton is responsible for over 44% of world fibre production and 10% of global edible oil production. India is the world's second-largest cotton exporter and producer, after China. India, on the other hand, produces far less cotton than other cotton-growing countries. The agriculture sector's contribution to GDP has decreased over the last few decades, from more than 50% in the 1950s to 15.4% in 2017. (at constant prices). India is the world's second-largest producer of agricultural commodities, accounting for 7.39 percent of worldwide agricultural output. . Cotton crop production in 2015-2016 was 37.33 lakh bales (lint), up from 35.83 lakh bales in 2014-2015, a 4.19 percent increase. The increase in production in the area in 2015-16 is attributed to an increase in the number of people working in the area. Cotton crop production in 2015-16 was 358 kg/ha, down from 360 kg/ha in 2014-

15, a 0.56 percent reduction from the previous year. Area, productivity, and production crops from 2001-02 to 2015-16 (Anonymous, 2016). India's entire agricultural economic contribution exceeds that of the world's average economy, i.e. (6.4 percent). Cotton marketing is a specialised operation that involves handling, packing, and movement of cotton bales, as well as grading, quality checks, and payment issues. . Cotton, unlike other crops, must transit through numerous intermediary agencies and travel a great distance before reaching its final destination. The yield gap is calculated by subtracting the average yield achieved from the prospective yield (Lobell, Cassman, and Field, 2009).

When a new technology is adopted, it is common for production to become more variable. Before releasing a variety to farmers for adoption, it is trialled and demonstrated in research stations under various agro-climatic conditions. Farmers' yields, on the other hand, are typically lower than those recorded at research stations and demonstration plots, leaving a significant yield potential unfulfilled (Gaddi et al., 2002). Keeping the foregoing in mind, the study's goals were to estimate potential yield and actual production in cotton, as well as to detect the yield gap at the farmer holding level. Farmers' yields, on the other hand, are comparatively lower than those recorded at research stations and demonstration plots, leaving a significant yield potential unfulfilled. After identifying the constraints, efforts could be undertaken to minimize the yield gaps caused by these constraints. The current study had the desired objectives of estimating yield gaps in the study area, determining the causes of yield gaps, evaluating the constraints that cause yield gaps, and suggesting suitable solutions to reduce yield gaps in cotton production in the study area.

METHODOLOGY

The data for the study were obtained by personal interview method from the selected cotton growers of the study area. Keeping in view the objectives and nature of the study, an extensive schedule was prepared to obtain data from the sample farmers. The selected farmers were personally contacted, interviewed and the required information was collected from them. The simple random sampling method was followed for the conduct of the study. The study was conducted in district Bhadradri Kothagudem, Telangana State, as the study is related to the production of cotton because the cotton crop is one of the major crops of the Kharif season in the district. So, Bhadradri Kothagudem district was one of the largest cotton cultivating district in Telangana along with diversified cotton cultivation. There was a random selection of Bhadradri Kothagudem for the study. The next move was to select respondents from a complete list of farmers from the villages chosen together with their size

of holdings were obtained with the aid of specialists in the subject matter. All the selected district divisions, along with the status of cotton cultivating area and production, will be prepared. Out of these divisions, one division having a more substantial area under cotton and diversified cultivation has selected. Furthermore, all the blocks / mandals selected under the division has been listed, and from among them, two blocks / mandals has selected with the most significant area under cotton cultivation. One village or more from each block had chosen randomly, keeping in view the availability of a sufficient number of respondents. List of all farmers in the villages chosen according to the size group had prepared. Using probability proportional to size sampling, 60 farmers are randomly assigned from every block, and therefore, 120 responders would be the maximum sample size.

The yield gap was measured using a method introduced by Manila, Philippines International Rice Research Institute (IRRI) as used by **Singh (2015).** Potential yield (PY) was defined as crop yield per hectare achieved at the research station. Potential farm yield (Yd)/ Progressive farm yield (Yd) is the maximum yield which is obtained by the grower in a category of farm size, and the actual yield (Ya) was derived as the per hectare yield produced by the growers on their fields. The total yield gap (TYG) is defined as the gap between the theoretical yield (YP) and real yield (Ya) (Eq.1), respectively.

TYG = YP – Ya [Eq.1]

The Total Yield Gap comprises of Yield Gap I and Yield Gap II.

Yield Gap I (YG I): It is the gap between the potential yield (YP) and the yield (Yd) (Eq.2) of Progressive Farmers.

YG I = YP – Yd [Eq.2]

Yield Gap II (YG II): It is the gap between the Progressive farmers' yield / Potential Farm Yield (Yd) and the Actual Yield (Ya) (Eq.3).

YG II = (Yd – Ya) [Eq.3]

Index of Yield Gap (IYG): The differentiation is expressed in percentage (Eq.4) between the potential yield (YP) and the actual yield (Ya) to the potential yield (YP).

IYG = [YP – Ya/YP] x 100 [Eq.4]

Index of the Realized Potential Yield (IRPY)

IRPY = [Ya/YP] x 100 [Eq.5]

Where,

Ya = Actual yield

YP = Potential yield

Index of the Realized Potential Farm Yield (IRPFY)

IRPFY = [Ya/Yd] x 100 [Eq.6]

Where,

Ya = Actual yield

Yd = Potential farm yield

RESULTS AND DISCUSSION

It is a pre-established fact that crop variety does not perform similarly when subjected to different agro-climatic and diverse agricultural practices. The variation in performance of crop variety is termed as yield gap. In the methodology developed by IRRI to estimate the magnitude of yield gaps, the yield obtained at research stations, progressive farmers plot, and farmers' fields, respectively, was defined as the possible yield, farm yield, and farm yield. The gap in yield includes two components. The first variable yield gap I indicates the difference between the Research Station yield and the progressive farmers plot yield. The second component - yield gap II is the difference between the progressive farmers' plot yield and the average farmer's actual yield **(Alam, 2006).**

Table: 1 Yields obtained from cotton growing on different farms

S. No.	Farm type	Yield obtained (q/ha)
1.	Potential yield	35.50
2.	Progressive farmers yield	30.17
3.	Marginal farms	27.15
4.	Small farms	25.44
5	Medium farms	29.49
6.	Large farms	29.15
7.	Average farm yield	27.80

The yields obtained from sample respondent farms are pretended in table 1 the potential yield and progressive farmer's yield of cotton were obtained from published sources. On an average of all the varieties grown in the state of Telangana, the potential yield was reported to 35.50 q/ha, and a progressive farmer's field was around 30.17 q/ha. The respondent's yield was found to be comparatively high in medium farms (29.49 q / ha), followed by large farm size group (29.15q / ha) marginal farm size group (27.15 q / ha) and was observed to be 25.44 q / ha for small farm size groups.

Table: 2 Yield gap in cotton on sample farms

Particulars	Marginal	Small	Medium	Large	Overall
Potential farm yield	35.50	35.50	35.50	35.50	35.50
Progressive farmers' yield	30.17	30.17	30.17	30.17	30.17
Actual farmers' yield	27.15	25.44	29.49	29.15	27.80
Yield gap I (%)	15.01	15.01	15.01	15.01	15.01
Yield gap II (%)	10.01	15.68	2.25	3.38	7.86
Total yield gap (%) (YG-I + YG-II)	23.52	28.34	16.93	17.89	21.69

Table 2 indicates gaps in yield. The yield gap I, or the difference between the potential yield and the progressive farmers' plot production, was 15.01 percent, according to the findings. Farmers find it difficult to attain yields that are comparable to potential yields since potential yield refers to yield obtained under ideal conditions for a particular variety, which may be impossible for a farmer to achieve in their own field. Yield gap-II is attainable yield, which could be obtained by adopting the technologies adopted by a progressive farmer in the study area, an average yield gap II was estimated at 7.86%. For the farm size group, it was estimated to be comparatively high for the small farm size group, i.e., 15.68%, followed by marginal (10.01%), big 3.38%, and medium 2.25%. The small farmers were observed to be engaged in other allied activities in the study area. This may be one of the reasons for the high yield gap, as they had not paid more attention to cotton farming. Marginal farmers were observed to be resource-poor; hence they could not get an optimal yield of cotton. It was pertinent to mention here that medium farmers were found comparatively rich in resources and technologically sound. Hence, the yield gap was comparatively low on medium farm size groups.

Crop production depends mainly on the quality of the services used and the overall management of crops. Many farmers have been found that they did not follow the recommended package of practices, which contributed to a significant gap in between potential farm yields and actual farm yields. To narrow down the yield gap in cotton, the factors causing the yield gap had to be established. The functional analysis of yield gap in cotton revealed that the gap between the recommended levels of all key inputs at progressive farmers plot and actual input use levels was found to be a major reason for wide variations in realizing the potential farm yield on sample farms. An inference can be drawn from the results, which could minimize the yield gap-II by adopting recommended levels of key inputs.

Conclusion and recommendations

In the case of cotton in the state, the yield gap analysis showed an untapped yield potential; Small producers had the largest yield gap that can be resolved by the implementation of recommended research stations practices. Factors leading to the yield gap provided an overview of the yield gap. Among the various factors, seed, fertilizer dose, pesticides, manures and labour were the key factors which could result in reducing the yield gap by increasing their respective quantities at the recommended stage. Farmers' fields were subjected to poor cultural practises, which resulted in a yield gap of 21.69%. Farmers usually do not adopt a technology as a package, instead opting for individual practises that are customized to their budget, management, and ability to execute, resulting in variability in the adoption of cultural practises and, as a consequence, yield gaps. As a result, cultural practises including such sowing time, recommended dose and balanced use of plant nutrients, plant protection measures, weeding, and intercultural operations have been absolutely essential for maximising undervalued farm potential at a minimal price. It is, therefore, recommended that they seriously explore the scope to promote yield by narrowing the existing yield gaps in crops and thereby ensure food security. Small farmers with little resources may not be able to attain high yields despite getting training and skills. This is due to the fact that these farmers are rarely able to purchase the necessary quantity of inputs to achieve such a yield. As a result, the government must take action to ensure that these farmers receive appropriate loans in a timely manner. Actions should also be done to lower transaction costs, simplify financing procedures, adjust eligibility criteria, and strengthen the current credit system's monitoring and supervision mechanisms. So an intensive research effort is needed to modify the existing technology to reduce the non-transferable component of technology to exploit the yield potential of cotton.

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