Performance of *Rabi* Sorghum variety Phule Suchitra Under Rainfed Condition in Solapur District of Maharashtra, India

S G Jadhav[1], T R Walkunde [2], and VG Vairagar [3]

Krishi Vigyan Kendra, Mohol (Solapur-II) Ta. Mohol Dist. Solapur

Mahatma Phule Krishi Vidyapeeth, Rahuri - 413 722 (MS), India

E-mail: sharadjadhav48@gmail.com

ABSTRACT: Sorghum is an important crop among the major cereals, the staple food and fodder crop of the worlds population located primarily in the semiarid tropics. Front line demonstration on *rabi* sorghum variety Phule Suchitra with integrated crop management practices was conducted by Krishi Vigyan Kendra, Mohol (Solapur II) during 2020-2021, 2021-2022 and 2022-2023 in Solapur district of Maharashtra. The results from frontline demonstrations from 2020 to 2023 revealed that there was 28.57 to 36.25% improvement in *rabi* sorghum var. Phule Suchitra grain yield over local checks. Higher grain yield of 2025, 2221, 2350 kg/ha were observed during the study period in comparison with the local check. The results showed that there was improvement in fodder yield of *rabi* sorghum var. Phule Suchitra to an extent of 29.03 to 34.66% over the local checks. The improvement in yield was mainly due to adoption of improved variety and recommended improved package of practices. The adoption of technology in frontline demonstrations was studied through technology index and the recommended package of practices being followed by the farmers. Technology index for grain yield varied from 2.08 to 15.62 and for fodder yield it varied from 22.30 to 38.46 during the three years of demonstration. Economic analysis concluded that the average benefit : cost ratios of demonstration plots (2.25) were significantly higher over control (1.64). The benefit: cost ratio of the system proved the economic viability of the interventions made under demonstration and convinced the farmers on the utility of interventions.

Keywords: Sorghum, frontline demonstration, technological intervention, technology gap, extension gap, net income, grain yield, fodder yield.

Introduction

Sorghum (*Sorghum bicolor* (L.) Monech) is one of the important cereal crops globally grown after wheat, rice, maize and barley. Sorghum is an important crop in semiarid tropics. In India it is a staple food in the states of Maharashtra, Karnataka, Telangana , Madhya Pradesh, Rajasthan and Gujarat. Sorghum is cultivated in India during *kharif* (rainy) and *rabi* (post rainy) seasons. Sorghum is an excellent source of energy, contains 349 k cal, 10.4 g of protein, 1.9 g of fat and 72.6 g of carbohydrate and also has good amount of minerals particularly iron (4.1mg/100g) and zinc (1.6 mg/100g). Modern genetic alterations are being used to modify cereals to increase their nutrient content. These approaches have the potential to have a major impact on the malnutrition of population groups who derive their dietary energy from a single staple cereal. Sorghum being a good source of nutrient and a common food grain for most of the population; it can be well exploited for combating the deficiency of nutrients. Hence, better nutrient composition promotes nutritional empowerment of people dependent on sorghum as a staple food in rainfed condition.

Rainfed *rabi* sorghum is mostly grown on quality of rains and water holding capacity of soil, and available production technologies. Compared to potential productivity, *rabi* sorghum productivity in farmer fields is low. The lower production and productivity is mainly due to poor crop management *i.e.* non adoption of improved cultivars, moisture conservation practices, integrated nutrient management and integrated pest and disease management practices. This wide gap between the farmers yield and realizable yield potential is to be bridged by adopting the improved agronomic practices. Thus, there is a need to popularize the recommended package of practices among the farming community through various demonstrations in the farmers field. The demonstration is the long-term educational activity conducted in a systematic manner in farmers field to show worth of a new technology. “Seeing is believing” is the basic philosophy of field demonstrations. Field demonstrations educate farmers through results obtained in terms of improved package of practices to get overall higher yields. Frontline demonstrations (FLD) play a major role in dissemination of the agricultural technology among the farming community. Hence, the present attempt was planned to demonstrate the improved sorghum production technologies through front line demonstrations in the farmers field to achieve the maximum productivity.

Material and Methods

Front line demonstration on *rabi* sorghum variety Phule Suchitra with integrated crop management practices was conducted by

Table 1: Grain yield (kg/ha) and yield gap analysis of front-line demonstration on *rabi* sorghum variety Phule Suchitra during 2020-21, 2021-22 and 2022-23.

Year	Number of demonstration	Potential grain yield (kg/ha)	Average grain yield (kg/ha)		Per cent increase	Technology gap (kg/ha)	Extension gap (kg/ha)	Technology index (%)
			Demo	Farmers practice				
2020-21	15	2400	2025	1575	28.57	375	450	15.62
2021-22	15	2400	2221	1630	36.25	179	591	7.4
2022-23	15	2400	2350	1750	34.28	50	600	2.08
Mean	15	2400	2196.6	1651.6	33.03	201.3	547	8.36

Krishi Vigyan Kendra, Mohol (Solapur II) during 2020-2021, 2021-2022 and 2022-2023 in Solapur district of Maharashtra. Frontline demonstration was carried out with a view to study the impact of improved technologies on the grain and fodder yield of *rabi* sorghum in farmers field. A total of 45 frontline demonstrations were conducted in an area of 0.4 ha in each farmers field. Two plots of one-hectare area was selected for laying out demonstrations. In one plot, the improved technologies *i.e.* certified seeds of improved variety Phule Suchitra supplied to the farmers, while other management practices *viz.,* seed treatment, integrated nutrient management, moisture conservation measures implemented by farmers under the guidance of Krishi Vigyan Kendra's scientist. In other plot the *rabi* sorghum was cultivated with farmers traditional practices which was taken as a control for comparing the impact of improved technologies. In addition to this, data on traditional practices fallowed by the farmers have also been collected. Technology gap, extension gap, and technology index were calculated as per the standard methods. The demonstration were conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and technology index. The yield data were collected from both the demonstration and farmers practice by random crop cutting method. The data was analyzed by using simple statistical tools. The per cent increase yield, technology gap, extension gap and technology index were calculated by using following formula as per Samui *et al.* (2000), as given below:

$$\text{Per cent increase in yield} = \frac{\text{Demonstration yield - Farmers practice yield}}{\text{Farmers practice yield}} \times 100$$

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Farmers practice plot yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{potential yield}} \times 100$$

Results and Discussion

Frontline demonstrations are effective educational tools in introducing various new technologies to the farmers and its adoption by building confidence on the basis of results obtained on their fields. The results from frontline demonstrations from 2020 to 2023 revealed that there was 28.57 to 36.25% improvement in *rabi* sorghum var. Phule Suchitra grain yield over local checks. A comparison between the farmers practice and *rabi* sorghum var. Phule Suchitra with suggested scientific integrated crop management practices would indicate the technology gap in yield adoption. The grain yield, technology gap, extension gap and technology index analysis of *rabi* sorghum var. Phule Suchitra presented in **Table 1** reveals that production of *rabi* sorghum yield was found to be substantially higher than that of farmers practices. During the study period, higher grain yields of 2025, 2221, 2350 kg/ha were noted in comparison to local check. Similar results were reported by Ashoka *et al.* (2020).

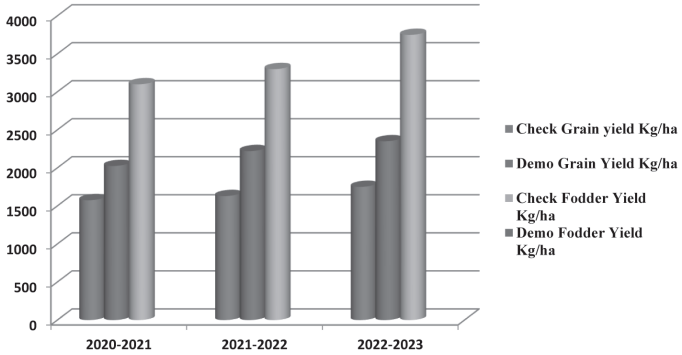

Fig. 1: Grain and fodder yield of demonstration plots and farmers practice

A perusal of **Table 2** reveals that the results on fodder yield showed that there was improvement in *rabi* sorghum var. Phule Suchitra fodder yield to an extent of 29.03 to 34.66% over the local checks. In demonstration plot of *rabi* sorghum var. Phule Suchitra recorded the highest fodder yield 5050 kg/ha during 2022-2023, while during 2020-2021 produced lowest fodder yield of 4000 kg/ha. In local check, maximum fodder yield 3750 kg/ha was recorded during 2022-2023, while the minimum fodder yield 3100 kg/ha was recorded during 2020-2021. However, the potential grain yield of *rabi* sorghum var. Phule Suchitra is 2400 kg/ha, while the potential fodder yield of the demonstrated variety Phule Suchitra is 6500 kg/ha. In general grain and fodder yields in demonstrated plots of *rabi* sorghum var. Phule Suchitra was higher than the local checks which were mainly due to adoption of improved variety and recommended improved package of practices in front line demonstrations. Similar findings were reported by Basavaraj *et al*. (2022).

Table 2: Fodder yield (kg/ha) and yield gap analysis of front-line demonstration on *rabi* sorghum variety phule suchitra during 2020-21, 2021-22 and 2022-23

Year	Number of demonstration	Potential fodder yield (kg/ha)	Average fodder yield (kg/ha)		Per cent increase	Technology gap (kg/ha)	Extension gap (kg/ha)	Technology index (%)
			Demo	Farmers practice				
2020-21	15	6500	4000	3100	29.03	2500	900	38.46
2021-22	15	6500	4500	3300	36.36	2000	1200	30.76
2022-23	15	6500	5050	3750	34.66	1450	1300	22.30
Mean	15	6500	4516.6	3383.3	33.35	1983.3	1133.3	30.50

The data regarding technology gap, extension gap and technology index presented in **Table 1** and **2.** An extension gap of grain yield between demonstrated technology and farmers practice range from 450, 591, 600 kg/ha during three years of study and on an average the extension gap was 547 kg/ha **Table 1.** This gap might be attributed to adoption of improved technology in demonstrations which resulted in higher grain yield than the traditional farmers practices. Technology gap was observed during different years and this was lowest 50 kg/ha during 2022-2023 and was highest 375 kg/ha during 2020-2021. The average technology gap of grain yield was 201.33 kg/ha. The difference in technology gap during different years could be due to more feasibility of recommended technologies during different years. Similarly, with regard the fodder yield **(Table 2)** the technological gap was observed during different years and this was lowest 1450 kg/ha during 2020-2021. The average technology gap of fodder yield 1983 kg/ha. The extension gap varied from 900 to 1300 kg/ha for fodder yield indicating the need to educate the farmers in adoption of improved package of practices. The adoption of technology in frontline demonstrations was studied through technology index and the recommended package of practices being followed by the farmers. Technology index shows the feasibility of the evolved technology in farmers' fields. The lower the value of technology index shows the feasibility of the technology. Technology index for grain yield varied from 2.08 to 15.62 and for fodder yield it varied from 22.30 to 38.46 during the three years of demonstration. Similar observations were reported by Nagarjuna *et al*. (2022).

The data regarding various economic indicators like gross return, net return and benefit: cost ratio of frontline demonstrations are presented in **Table 3.** The economic indicators clearly showed that the net return from the recommended practices were substantially higher than the control plot *i.e.* farmers practice during the demonstration period. The average gross returns from the demonstration were higher (₹ 88451.6) in comparison to the farmers practice (₹ 66391.6). Similarly, the average net returns from the front-line demonstrations were higher (₹ 49885) in comparison to the farmers practice (₹ 26625). Additional income was received through the technological interventions like use of improved variety according to soil type, *viz.,* Phule Suchitra, moisture conservation practices, integrated fertilizer application, intercultural operations and other integrated crop management practices. Economic analysis concluded that the benefit: cost ratios of demonstration plots (2.25) were significantly higher over control (1.64). The benefit: cost ratios of the system proved the economic viability of the interventions made under demonstration and convinced the farmers on the utility of interventions. The results of frontline demonstration showed that the yield of sorghum could be increased with the help of innovative technological interventions.

Conclusion

Frontline demonstration programme was effective in changing the attitude of farmers towards *rabi* sorghum cultivation. Cultivation of demonstration plot of *rabi* sorghum variety Phule Suchitra with recommended improved technologies has increased the skill and knowledge of the farmers. This also improved the relationship between farmers and scientist and built good rapport between them. Farmers who used the new technology to demonstrate it served as the primary source of information for other farmers with the enhanced sorghum cultivation methods. The concept of front-line demonstration may be applied to all categories of farmers including progressive farmers for speedy and wider dissemination of the recommended practices to other members of the farming community.

Table 3: Economics of *rabi* sorghum frontline demonstrations and existing farmers practice

Year	No. of Demo	Area (ha)	Gross income ₹ /ha		Net income ₹/ha		B:C ratio	
			Demo	Farmers practice	Demo	Farmers practice	Demo	Farmers practice
2020-21	15	6.0	64000	50200	31200	15800	1.95	1.46
2021-22	15	6.0	84630	62100	47430	24100	2.27	1.63
2022-23	15	6.0	116725	86875	71025	39975	2.55	1.85
Mean	15	6.0	88451.6	66391.6	49885	26625	2.25	1.64

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