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Highest productivity achieved in post-rainy *(rabi)* sorghum:

A success story of an award-winning farmer of Maharashtra

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This success story proved that the improved sorghum production technologies which were developed by NARS have huge yield potential if these were adopted with careful management of each plant and high input use especially of micro nutrient as practiced by the awarded farmer. Several such high yield potential technologies are available at the research organizations which need to be adopted by the farmers' in other areas with precise management and passion. They can enhance sorghum productivity by many folds and lead to double and even triple farmers' income and recurrence of the reduced sorghum area. There is a need to organize regular motivational programmes like crop composition and farmers' recognition at various levels by the policymakers to promote agriculture and achieve the goal of food, nutrient and income security

Keywords: Highest productivity, Improved technology, Innovative practice, Post-rainy (*rabi*) sorghum.

SORGHUM (*Sorghum bicolor* L. Moench) is one of the major cereals after wheat, rice, maize and pearl millet which is being cultivated by all categories of farmers' in semi-arid regions of the country. Now-a-days, the sorghum farmers' mostly prefer dual purpose cultivars rather the grain purpose alone, due to meeting their important requirement of fodder, food and nutrition. Besides basic research, the national agricultural research system (NARS) is attempting to build-up linkages between research, extension and farmers' to outreach the technologies by implementing technology transfer programmes such as, frontline demonstrations (FLDs) since 1995–96. The efforts made by ICAR-Indian Institute of Millets Research (IIMR), Hyderabad with the help of All India Coordinated Research Improvement Project on Sorghum (AICRP-Sorghum) and State Agricultural Universities (SAUs) since its inception, has led to development of technologies for enhancing production and productivity in order to meet requirement of food, fodder and feed. In view of this, many FLDs on sorghum including post-rainy sorghum were organized to evaluate and demonstrate the production potential of the latest sorghum cultivars including a package of practices in the farmers' fields. Besides, it enables to build-up confidence of the farmers' to adopt the latest technologies and also help to collect first-hand feedback to modify the research programme based-on field performance of the technologies. The post-rainy (*rabi*) sorghum produce is used both for human consumption, fodder and feed for cattle. Thus, it is the key for the sustenance of human and livestock populations. However, the productivity of *rabi* sorghum was around 1 tonnes (1002 kg/ha during 2019–20) because it was mostly grown on residual moisture of the rainy season under rain-fed conditions with low fertilizers and inadequate use of technologies. Low remuneration coupled with lack of policy and market support was among the major de-motivating factors. Hence, few programs have been organized by different state governments like crop competition and farmers' recognitions with awards and incentives in order to motivate them for agricultural development. Under such initiative,

Sh. Sahebrao Manyaba Chikane
Area: 0.40 ha

the Maharashtra government had recently awarded one of the sorghum farmers' namely, Shri Sahebrao M. Chikane of Satara district as "Best Farmer Award" on the occasion of "Krishi Din" also known as "Agriculture Day" celebration on 01 July 2021. His success story of achieving highest sorghum productivity by adopting innovative crop management practices has been highlighted in this article for benefits of many other sorghum farmers' and stakeholders for their motivation and further development.

Innovative cultivation practices followed by the award-winner farmer

The cultivation practices used by him were mostly recommended cultivation practices by the NARS and demonstrated through FLDs during seven years (2010–11 to 2017–18) with few modifications such as, enhanced plant to plant spacing of 20 cm instead of recommended 15 cm and innovative additional nutrient management using micro fertilizers and inter-cultivation practices as given below;

Variety used: Phule Revati

It is a sorghum variety tested in All India Coordinated Research Project on sorghum and was later released by Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra at state level for *rabi* season which is suitable for medium to deep soils under irrigated conditions in 2010. The same variety was demonstrated in farmers' fields by the IIMR through the FLD programme.

Land preparation: One deep ploughing with moldboard plough in summer followed by two tillage practices in cross-direction.

Source of seed: Seeds of sorghum of selected cv. Phule Revati obtained from Mahabeej (Maharashtra State Seed Corporation) through the State Agriculture Department.

Seed treatment:

- *Vitavax* (locally available fungicide of private company) (10 g) and Gaucho (imidacloprid) (10 ml) for 4 kg seeds and
- Azotobacter (100 g) + Phosphorus solubilizing bioagent (100 g) + Jaggery (25 g) mixed in 100 ml water.
- Seeds were treated with the above solution just four hours before sowing.

Seed rate and spacing: Seed rate @4 kg/acre was used and spacing was maintained between row to row distance of 45 cm and plant to plant of 20 cm.

Method of sowing: Seeds and fertilizers were sown together using bullock drawn seed-drill.

Time of sowing: The sowing was done in September.

Fertilizers used:

- At the time of sowing, farm yard manure (5 cart load) + Neem cake (100 kg) + NPK (10:26:26) fertilizer (150 kg) + Silicon (5 kg) + $FeSO_4$ (8 kg) + ZnSO4 (8 kg) + $MgSO_4$ (5 kg) + Humic acid granules (10 kg) + Fatera (micronutrient fertilizer of private company) (4 kg) were used.
- After 30 days, Urea (50 kg) along with irrigation was used.

Weed control:

- Atrazine was sprayed on moist soil just after sowing.
- One intercultural operation was performed after 15 days and,
- One hand weeding was done after 15 days.

Insect-pest control:

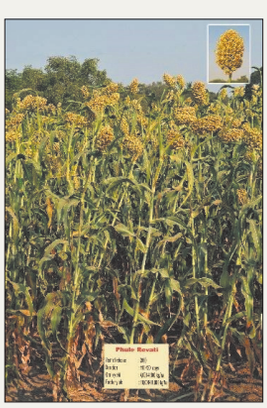
- After 15 days, spraying of chlorpyrifos @30 ml in 15 litre of water
- After 30 days, spraying of emamectin @8 g in 15 litre of water + Dithane M-45(30 g)

Innovative practices and inter-cultivation:

- One inter-cultivation after 12 days and thinning with keeping 20 cm distance between plants was done.
- Self-made liquid bio-fertilizer (jivamrut) was used @200 litre/acre at 30 days and 45 days along with irrigations.
- After 21 days, liquid mix fertilizer 19:19:19 (NPK) was sprayed @1.00 kg/acre (100 g in 15 litre water)
- After 30 days, calcium nitrate was sprayed @1.00 kg/acre (100 g in 15 litre water)
- After 40 days, mix fertilizer 0:52:34 (NPK) was sprayed @1.00 kg/acre (100 g in 15 litre water) + Chilmix (locally available micronutrient fertilizer of private

Phule Revati

Pedigree	CSV 216 × SPV 1502
Duration (days)	118–120
Grain yield (q/ha)	40–45 t/ha
Dry fodder yield (q/ha)	90–100 t/ha
Year of release	2010
Salient features	• Suitable for medium to deep soils under irrigated conditions. • Plant height 210–220 cm, non tan type, cylindrical semi compact panicle, white midrib leaf, semi-drooping leaf orientation. • Medium bold pearly white round grain and better fodder quality than CSV 216R. • Tolerant to shoot fly and charcoal rot disease.
Centre of development	AICRP-Sorghum, MPKV, Rahuri, Maharashtra State



Field view of Phule Revati plot along with farmer, his family and state department officials

company) @250 g/acre (15 g in 15 litre water)

- After 60 days, mix fertilizer 13:0:45 (NPK) was sprayed @1.00 kg/acre (100 g in 15 litre water) + Silicon @250 g/acre (15 g in 15 litre water)

Productivity potential of sorghum production technologies

The fact of obtaining 40.4 tonne per acre grain yield extrapolated to 10.10 tonne per hectare by farmer namely, Shri Sahebrao M. Chikane of Songaon village in Satara district of Maharashtra indicates production potential of 10.1 t/ha of sorghum cultivar under irrigated condition in deep black soil. This highest achievement of yield was the result of the best management practices, better endowed soils and use of high yielding variety developed from NARS which ensured the farmer to realize double and even triple farmers' income. This variety was continuously demonstrated in several farmers' fields in western Maharashtra during 2010–11 to 2017–18 through FLDs, after it was released by the MPKV, Rahuri, Maharashtra state for medium to deep black soils. It was one of the best performing varieties among the FLD trials conducted by the IIMR along with MPKV, Rahuri during 2010–11 to 2017–18 yielding up to 7.20 t/ha grains. The productivity of rabi sorghum (10.1 t/ha) achieved by the awardee farmer is 10 times higher than the FLD (7.20 t/ha), national productivity (1.00 t/ha), double than the research station yield (4.50 t/ha), more than seven times than district average yield (1.40 t/ha) and ten times more than state average yield (0.80 t/ha). In fact, under irrigated conditions in medium to deep black soils the potential of other latest varieties (CSV 29R, PKV-Kranti) is more than 7.00 t/ha. New sorghum hybrids for *rabi* have recorded up to 6.2 tonnes yield per hectare under irrigation. In rice fallows of coastal Andhra Pradesh which is non-traditional sorghum area, a *kharif* hybrid (CSH 16) was yielded 9.00 t/ha grain yield which has potential up to 11.00 t/ha in such high-input condition.

SUMMARY

These results are from 0.40 ha area achieved by the awardee farmer in which he cultivated Phule Revati variety for crop competition held in the Maharashtra state to demonstrate higher productivity with best management practices of every plant and using adequate micro nutrients to obtain maximum yields. This is an example how individual plant care with adoption of better recommended crop management practices including, plant geometry, agronomy and use of additional micro nutrients can help to double the research station average yields from 4.50–10.1 tonnes per hectare. This example of efficient use of inputs also substantiates our trials on achievable yields to the tune of 10.1 tonnes per hectare. It shows that sorghum responds very well to high input conditions to obtain more than double the research station yields. The efforts of farmers' like Shri Sahebrao Chikane of Satara district, Maharashtra are exemplary and it proves that doubling the farmers' income is possible by adopting high yielding cultivars along with best management practices and adequate micro nutrients. Hence this effort of Shri Chikane is very appreciable and has got recognized by the government of Maharashtra. Such adoption of a complete package of technologies with plant-wise careful management needs to be adopted by other farmers'. It is a lesson of motivation to other farmers' to go for improved sorghum cultivation that provides both food, nutrients and also much needed fodder security in the country. Also, it will help to resurrect back the lost area of sorghum.

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Know Krishi Unnati Yojana

The Krishi Unnati Yojana, a central sector scheme, is envisaged as umbrella programme for focusing on food security, by merging schemes on Soil-health Card, Integrated Scheme on Agricultural Co-operation and Agricultural Marketing, National Mission on Agriculture Extension, Horticulture Development, Price Stabilization Fund, National Mission on Sustainable Agriculture and other programmes.