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Annual Report on CRP-Seed PL-7 Project

2018-2019

Submitted to
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Sorghum Improvement Project
Mahatma Phule Krishi Vidyapeeth, Rahuri - 413722

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ABSTRACT

Mahatma Phule Krishi Vidyapeeth has developed and recommended the *rabi* sorghum varieties for different soil types with better grain yield and fodder quality. However, these varieties are spread on not more than 15% area. Still 80-90% of the farmers are using their own *rabi* sorghum seed. The reason behind this is the unavailability of seed of improved *rabi* sorghum varieties. Now a day the *rabi* sorghum seed is available below 5% of the total area. Therefore, though the university has developed good high yielding varieties, they have not reached to all farmers. The main objectives of the project is to develop production linkage of breeders, foundation and certified seed which will fulfill demand of at least 50% area of *rabi* sorghum. Therefore, the seed production of *rabi* sorghum varieties was under taken in collaboration with ICRISAT, Hyderabad, Mahabeej, National Seed Corporation, Department of Agriculture and M.P.K.V. Rahuri in the jurisdiction of M.P.K.V. Rahuri i.e. Ahmednagar, Pune, Satara, Sholapur and Jalgaon districts. The main objective of the project is to make available seed of *rabi* sorghum varieties to large number of farmers and increase the production and productivity of *rabi* sorghum.

The *rabi* sorghum seed production project under taken in the name of CRP-Seed Project (PL-7) was started from July, 2013 onwards with collaboration of ICRISAT, Hyderabad. During *rabi* 2018-2019 three clusters namely Ahmednagar, Pune and Sholapur were selected for this project. From these villages 1660 hectors area were chosen for the cultivation of **Phule Revati, Phule Vasudha, Phule Suchitra and Phule Anuradha** as *rabi* sorghum varieties for seed production. The improved crop production technologies were given to all farmers. Several trainings, farmers rallies, demos and actual practices shown to the farmers on their own farm. From these clusters total raw grain/seed yield obtained (928.18 + 510.1) = **1,438.28 quintals** during *rabi* season 2018-19. These seeds are procured by the Mahabeej Seed Corporation. These seeds will be making available to the farmers during *rabi* season 2019-2020.The decrease in area and yield during this year is due to severe draught condition.

Background and Importance of CRP-Seed Project

In Maharashtra the area under *rabi* sorghum is more than *kharif,* however the production & productivity is less than *kharif* sorghum. The main reason is that the *rabi* crop is harvested under rainfed situation with receding soil moisture of *kharif* rains. Moreover, the *rabi* sorghum crop is sown in 23% shallow, 48% medium and 29% deep soil types. The farmers do not use the varieties as per the soil types also. These are the hurdles in *rabi* sorghum production.

Mahatma Phule Krishi Vidyapeeth has developed and recommended the *rabi* sorghum varieties for different soil types with better grain yield and fodder quality. However, these varieties are spread on not more than 15% area. Still 80-90% of the farmers are using their own *rabi* sorghum seed. The reason behind this is the unavailability of seed of improved *rabi* sorghum varieties. Now a day the *rabi* sorghum seed is available below 5% of the total area. Therefore, though the university has developed good high yielding varieties, they have not reached to all farmers. The main objectives of the project is to develop production linkage of breeders, foundation and certified seed which will fulfill demand of at least 50% area of *rabi* sorghum. Therefore, the seed production of *rabi* sorghum varieties will be taken in collaboration with Maharashtra State Seed Corporation (Mahabeej), National Seed Corporation (NSC), Maharashtra State Department of Agriculture and Mahatma Phule Krishi Vidyapeeth, Rahuri in the jurisdiction of M.P.K.V.Rahuri i.e. Ahmednagar, Pune and Sholapur districts. The main objective of the project is to make available seed of newly released *rabi* sorghum varieties to large number of farmers and increase the production and productivity of *rabi* sorghum. Therefore this project is operating between ICRISAT and MPKV, Rahuri for the duration of 6 years from 2013 to 2019.

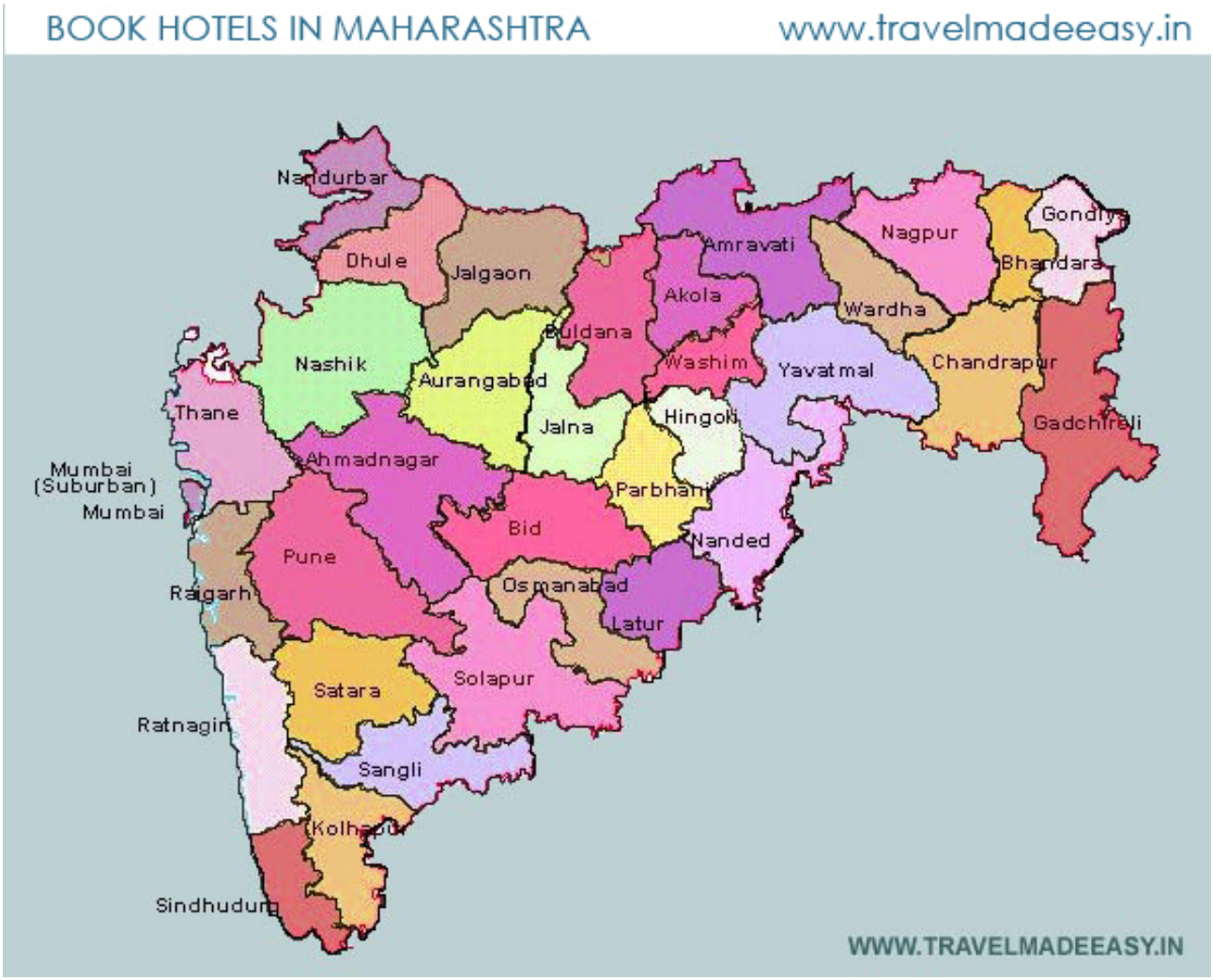
Staff position under CRP-Seed Project at MPKV, Rahuri during 2018-2019

Sr. No.	Name of the officer	Designation	Starting Date	Telephone No.
1.	Dr. R.W. Bharud	HOD, Botany and Administrative control	03-11-2017	02426-243249 9848378035
2.	Dr. A. S. Jadhav	PI of CRP-Seed Project & Senior Sorghum Breeder	23-7-2017	02426-233080 9850156605
3.	Dr. U. K. Kadam	CO-PI of CRP-Seed Project & Sorghum Entomologist	01-05-2018	02426-233080 9273531557
4.	Dr. M. S. Shinde	CO-PI of CRP-Seed Project & Sorghum Breeder	23-7-2013	02426-233080 9561887833

Brief Plan of the CRP-Seed Project at M.P.K.V., Rahuri

Name of the Project	**"CRP-Seed Production Project of *Rabi* Sorghum".**
Partners in the Project	ICRISAT, Hyderabad, Mahatma Phule Krishi Vidyapeeth, Rahuri Marathwada Krishi Vidyapeeth, Parbhani
Finance to the Project	Bill and Melinda Gate Foundation, USA
Period of the Project	6 Years (2013-14 to 2018-19)
Objective of the Project	The main object of this project is to produce quality seeds of high yielding new varieties (HYV) of *rabi* sorghum with the help of farmers and government agencies.
Layout of the Project	
Selected Districts for the Project	**Western Maharashtra:** Ahmednagar, Pune, Sholapur, Satara & Jalgaon
Numbers of selected villages in each District	5 – 8 (Five to eight villages)
Selected farmers from each village	250-500 (Two hundred fifty to five hundred)
Farmers in each cluster villages	1250-4000 (One thousand two hundred fifty to four thousand)
Total farmers during 6 year of the Project	17100 (Sixteen thousand and one hundred)
Improved varieties used for seed production of *rabi* sorghum according to the soil types	Heavy soil: **Phule Vasudha, Pule Revati** Medium Soil: **Phule Suchitra** Shallow soil: **Phule Anuradha**

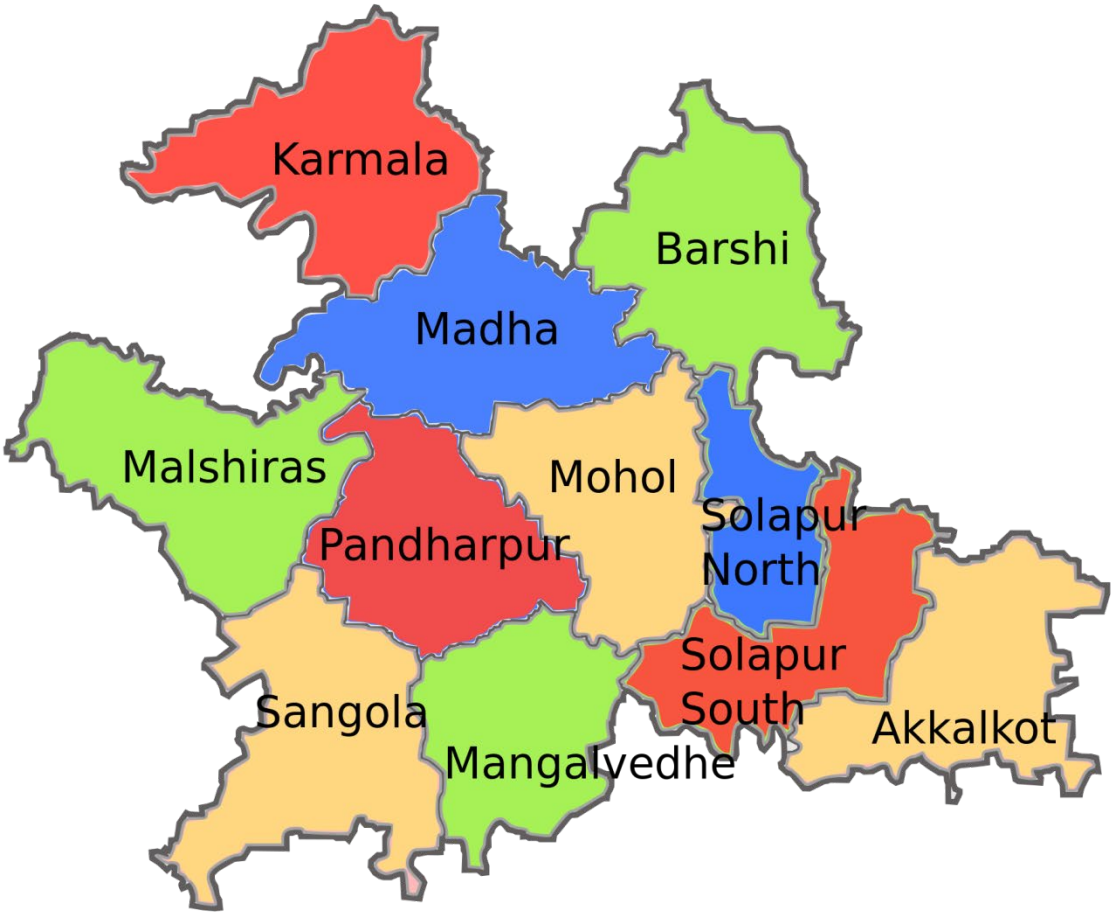
Maharashtra State



Ahmednagar District

Pune District

Sholapur District



Sr. No.	Date	Scientists/Officers	Purpose/Events/Remarks
1.	10-8-2018	Mr. Pandit Lonare DSAO, Ahmednagar Dr. U.K.Kadam Dr. S.K.Kambale Prof. S.V.Nirmal Mr.Nalage Saheb, SDAO, Karjat Mr.Sali,TAO, Shevgaon Mr. Daund Saheb Mahabeej Ahmednagar Mr. Deshmukh Saheb Mahabeej Ahmednagar	CRP-Seed Production planning meeting with Mahabeej District Manager, Ahmednagar for *Rabi* season-2018-19. Discussion was held for selection of villages and availability of sorghum seeds.
2.	31-8-2018	Mr. Mane Saheb SDAO, Solapur Dr. U.K.Kadam Dr. S.K.Kambale Dr.V.R.Patil Mr.Gaikwad TAO, Mangalvedha Mr.Gawande,TAO,Barshi Mr.Mahangade Saheb District Seed Certification Officer, Solapur Mr.Suryawanshi Saheb Mahabeej,Solapur	CRP-Seed Production planning meeting with Mahabeej District Manager, Solapur for *Rabi* season-2018-19. Discussion was held for selection of villages and availability of sorghum seeds.
3.	1-09-2018	Mrs Yadav Madam Tech.Officer, SAO,Pune Dr. U.K.Kadam Dr. S.K.Kambale Dr.V.R.Patil Mr.Kondhalkar Saheb, DSCO,Pune Mr. Pinjarkar Saheb Mahabeej,Pune Mr.Mali,TAO ,Indapur	CRP-Seed Production planning meeting with Mahabeej District Manager, Pune for *Rabi* season-2018-19. Discussion was held for selection of villages and availability of sorghum seeds.
4..	4-01-2019	Dr. U.K.Kadam Dr. S.K.Kambale Dr. M. S. Shinde Prof.S.V.Nirmal	Planning meeting regarding CRP-Seed Project implementation and sorghum crop production technology information given to the farmers of Narayanwadi village Tal. Nevasa of District Ahmednagar. Detail discussion was done on the seed production, processing marketing and distribution of sorghum seeds for *rabi* season 2018-19.

Rain water conservation technology for *Rabi* sorghum under CRP-Seed Project: 2018-2019

For rain water conservation for *rabi* sorghum cultivation under CRP-Seed Project for the year 2018-2019 at various cluster villages rallies were organized to give details about the improved technology. During rallies it is stated that if you use improved varieties/genotypes for rabi sorghum then the yield of grain and fodder will be increased up to 30% and if you use rain water conservation technology (in-situ moisture conservation technique) then the yield will be increased by another 25%, and after sowing the sorghum crop production technology is used then the yield will be increased up to 20% and if fertilizer management is done then another 15% yield will be increased and lastly if you use plant protection measure for pest and diseases during their growth period and the yield will be increased by another 10% over the control. This technology was well explained to the farmers by giving details about the experiments conducted at Sorghum Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri.

During this rallies and demos various photographs and charts were used to show the effectiveness of this scheme to improve the economical condition of the farmer by adopting this improved technology as well as improved sorghum cultivars. For land preparation for *rabi* sorghum one deep ploughing with mould board plough in summer followed by 3 to 4 harrowing to maintain weed free conditions. Making compartmental bunds of 10m x 20m in the month of August for soil moisture conservation/rain water conservation helps in increasing yield as mentioned above.

Rain water conservation technology demos on farmers field 2018-19

Using tractor to form beds for rain water conservation

Using tractor to form beds for rain water conservation

Using bullocks to form beds for rain water conservation

Rain water conserved in the compartment for *rabi* sorghum

Seed Distribution to Farmers under CRP-Seed Project during 2018-2019

For this purpose initially demos were organized to show how the seed treatments are given to the sorghum seeds before sowing.

Seed Treatment: Before sowing seed treated with sulfur and Bio-fertilizer. For 1 kg of *rabi* sorghum seed 4 gm sulfur thoroughly rubbed to the seeds before sowing. After sulfur treatment, seed treated with Azotobactor @ 250 gm/10kg seed.

During demos there were discussion on various aspects of sorghum cultivation practices, inter culturing practices, pest and diseases management and other issues between scientists and farmers. Sorghum crop cultivation demos were conducted at Sorghum Improvement Project, MPKV, Rahuri as well as on farmers' field to show the effect of new sorghum variety and technology on crop condition, ultimately on grain and fodder yield.

Seed distribution under CRP-Seed Project during 2018-19

During June-July selected active farmer's villages for Rabi Sorghum Seed Production Scheme at Ahmednagar, Pune and Sholapur districts. Before selecting the farmers all information regarding sorghum seed production was given to the farmers by MPKV, Rahuri Scientists. After convincing the famers about benefits from the seed production, selection of farmers was done and only one variety for each village was given to maintain required isolation. On the basis of the demand and number of farmers required varieties seed bags were supplied to the famers by Maharashtra State Seed Corporation Mahabeej at each districts. Mahabeej taken the guaranty to purchase the good seed produced by the farmers (buy back guaranty).

Department of Agricultural of State Government provided mini kits to the famers under coarse grain production scheme. Seed Certification agency verified the *rabi* sorghum seed plots and then certified according to their norms and rules. International Crop Research Institute for Semi-Arid tropics (ICRISAT) provided some finance to this scheme. Mahatma Phule Krishi Vidyapeeth, Rahuri provided all technical information follow-up programme and coordination with all four agencies for *rabi* sorghum seed production. These new sorghum varieties seed then made available to the farmers not only Maharashtra State but also for other States also. Due to this scheme the grain and fodder productivity of the State and the Country also increased.

Sorghum Seed Production Technology

Mahatma Phule Krishi Vidyapeeth, Rahuri

Seed is a living embryo and considered as the basic, critical & vital input for enhancing productivity of Agricultural crops. Seed is the carrier of production technology. Unless adequate quantity of good quality nucleus, breeder seed is made available to the seed producer, the desired impact of hybrids/varieties in boosting productivity cannot be realized.

Sorghum is an important cereal crop of the country primarily grown for food, feed and forages in dry land eco-system and occupies an area of nearly 8.0 million hectare. In India, major sorghum growing states are Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra, Madhya Pradesh, Gujarat, Rajasthan and Uttar Pradesh. Sorghum is grown during rainy (*kharif*) and post rainy (*rabi*) season. About 55 % area is under *kharif* season contributing 66 % of production and 45 % area under *rabi* season contributing 34 % production.

To meet the demand of bulging human population, upcoming dairy and industrial sector, there is a need to further consolidate the gain through research efforts and seed production planning to produce more seed and grain.

The improved seed is a vital component of production technology aimed at enhancing the yield.

General consideration for hybrid seed production

Seed field should have good fertility and drainage facilities.

The seed used in hybrid development must be pure (Nucleus/ Breeder) obtained from Govt. agencies, Agril. Universities.

Recommended package of practices like weed management, fertilizer dose, irrigations and plant protection.

Proper isolation distance must be maintained as prescribed by MSS.

The seed plot should frequently visit and monitored.

Rouging of off type and pollen shaders in (MS line).

Almost care should be taken at the harvesting to avoid the contamination.

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5. The seed plot should frequently visit and monitored.
6. Rouging of off type and pollen shaders in (MS line).
7. Almost care should be taken at the harvesting to avoid the contamination.
8. Use fresh bag to store the threshed seed and should be labeled inside and outside.
9. The inspections (at least three) should be carried out by seed certification Agency.

Seed Planning and production

The seed is the carrier of improved seed production technology. A strong seed programme is a precursor and indicator of potential realization of impact of genetic transformation alongwith the exploitation of heterosis. Seed is the most vital, but least expensive of the basic input of crop production. Though improved seed is expensive but it constitutes a small fraction of the total lost of cultivation. Scientific efforts have been made to boost the yield potential of sorghum by developing new hybrids, improved varieties and suitable production technology. To exploit the yield potential, it is necessary to have a sound seed production programme of hybrids.

The public sector agencies National Seed Corporation (NSC), State Farm Co-operation of India (SFCI), State Seed Corporations, State Department of Agriculture, National Research Institutes and State Agriculture Universities (SAU) and various private seed companies participate in seed production chain of hybrids and varieties. In India we follow 3 stage multiplication to seed called “generation system” from breeder to foundation of certified seed.

Seed production is accomplished through well organized steps *viz.*, Breeder's seed, foundation seed and certified seed. Initially breeder seed is produced at the experimental station where the variety / hybrid is normally developed but subsequently this responsibility is shared by various breeders in the country. The centers which presently participate in Breeder Seed Production (BSP) of the parental lines of popular hybrids to meet the central and state demand are:

Kharif BSP	*Rabi* BSP
PVK Akola	NRCS, Hyderabad
MAU, Parbhani	ANGRAU, Hyderabad
UAS, Dharwad	UAS, Dharwad
TNAU, Coimbatore	UAS, Bijapur
MPKV, Rahuri	CRS, Solapur
	MPKV, Rahuri.

The breeder seed can be aquired from these centers on indent/request. Breeder seed is allocated by the ministry of agriculture on prior indent received from State Department of Agriculture, MOA through ICAR pass on this indent for BSP to the Project Director who get it produced through its various centers in SAU's. Breeder seed is duly monitored for its genetic purity and field standard by a team consisting of Project Co-ordinator and nominees of National seed Co-operations, State Seed Production Agency and State Seed Certification Agency.

Foundation seed is the direct increase from breeder's seed or produced from the foundation seed which can be clearly traced to the breeder's seed. Foundation seed is produced by NSC, SFCI, SAU and State Seed Corporations.

Certified seed shall be the progeny of the foundation seed production shall be handled as to maintain specific genetic identity and purity according to standards specified for the crop being certified. Maharashtra State Seed Corporation, Andhra Pradesh State Seed Corporation and Karnataka State Seed Corporations are major agencies

for certified seed production. Various seed companies compliment these public sector agencies in seed production. Some private companies' market hybrid development by both public agencies and themselves but some of them are switching over to produce seed exclusively bred by them. Commercial seed is normally certified by a team of specialists from state certification agency, scientist of research station and state seed development corporation. However, seed certification under law is voluntary. Apart from certified seed, the seed is sold as truthfully labeled seed (TLC).

The seed of commercial hybrid is produced in *rabi* and summer season both by public and private seed agencies and marketed in summer season itself. However, seed for *rabi* has to be stored till the next *rabi*. Consequently, there is some difficulty in availability of seed for *rabi* which is one of the reasons for stagnation in production of *rabi* sorghum.

The seed production in *rabi* is predominantly concentrated in Andhra Pradesh and adjacent part of Karnataka due to favourable ecological condition. *Rabi* seed production has obvious advantages over *kharif* production due to:

- Seed production under assured irrigation.
- Warm temperature in AP and adjacent part in *rabi* is conductive for better growth than cold temperature in Maharashtra and other north states.
- Crop maturation under clean weather condition ensures high germination better luster and healthy bold seed.
- Better feasibility of staggering, manipulation of nicking/synchrony of flowering.
- Timely harvest and drying in summer months at filed and processing.
- Expeditious supply of seed for *kharif* sowing minimizing the storage losses in quality due to loss of viability, germination, vigour and storage pest and pathogens.

In view of the advantages, most of the seed producers even from outside states concentrate in Andhra Pradesh for foundation and certified seed production of sorghum hybrids.

Technique of hybrid sorghum seed production

Sorghum is considered to be often cross pollination crop, cross-pollination in grain sorghums ranging from 4-6 per cent. Commercial seed production in this crop is accomplished through the use of cytoplasmic genetic male sterility. In this system a male sterile line designated as a 'A' line is used as the female parent and crossed with a fertility restorers line designated as R line (male-parent). For production of A-line seed, a separate crossing block has to be established by growing alternatively 4 lines of A and 2 lines of B-line (maintainer-pollen producer). Similarly R-line has to be grown in a separate block by putting alternatively A and B lines, ratio being 4:2. Seed obtained form females parent of this crossing block is the certified seed, from which the commercial hybrid crop is raised. Procedure for Nucleus and Breeder seed

A) Nucleus seed production: I) Varieties and Restorer

1. Select around 700-800 typical earheads that are true to type, self them before anthesis. Number the picks serially.

2. Record observations on plant height, days to maturity and to other yield attributes while making selections.

3. Harvest and thresh the selected plants separately. Examine the seeds for uniform colour, shape and size and reject the produce of plant showing variation in any of these traits.

4. *Grow 6 m long row from each of the earhead selected during next cropping winter/summer season. Grow between 300-400 such plants to row progenies as paired rows by dibbling method to enable proper inspections.*

5. *Examine the progenies periodically throughout the growing season at ear emergence, flowering, physiological maturity and field maturity.*

6. *Reject and uproot the entire row if a single plant in row exhibits variation or non-uniformity to produce genetically high quality seeds. In selected lines self the individual plants before anthesis to avoid*

7. *Select 500-600 earheads from among the accepted progenies, harvest and thresh them separately and record their seed yields separately. The seeds of plants yielding higher than general mean ± 2SE are bulked to constitute the nucleus seed.*

I) Inbred lines

1. *Undertake mass selection in B lines based on stable diagnostic morphological characteristics specific.*
2. *Grow plant-row progenies of selected B lines adjacent to A lines planted from breeder seed source. Rogue out off-type progenies from B lines and self selected B lines.*
3. *Hand pollinates the seed parent rows (A lines) with the pollen collected from the desirable B line progenies. It is desirable to follow the pairing of A and B lines in 1:1 proportion.*
4. *Grow the seed obtained from hand pollination of A lines with B lines during next cropping season. Examine the progenies for genetical identify with the original stock. The seed of the pairs showing genetical purity is bulked and designated as nucleus seed of A lines. The seeds harvested from B lines rows are bulked and is designated as nucleus seed of B line.*

Breeder Seed Production

I) Varieties and Restorers

1. *Grow nearly 0.4 to 1.0 ha area using nucleus seed on clean and fertile land which did not grow the crop of the same kind in the previous year.*
2. *The row spacing should be sufficient (60 x 15 cm) to remove off type plants from rows. For effective inspection and rouging, skip one row after every 6-8 rows.*
3. *Field should be properly isolated as mentioned in Table1.*
4. *The rouging should be done before flowering.*
5. *A minimum of 3 field inspections shall be made before flowering during flowering and at maturity but prior to harvesting to verify isolation, volunteer plants, off-types and true nature of plant.*
6. *Take maximum care during harvesting, threshing, drying, processing and bagging to avoid any mechanical admixture to maintain higher genetic purity.*

II) Inbred line (A and B):

1. *For Breeder Seed Production of MS line (A), a row ratio of*

   2:4 (B:A) be adopted. The sowing should be done across the wind direction. Four rows of maintainer line (B) be planted around the breeder plot of male sterile line to increase the pollen load for better seed set.
2. *Field inspection shall be made as in case of breeder seed*

   production of open pollinated varieties and restorer lines. The rouing of off types and pollen shedders (from A line rows) shall be undertaken during flowering.
3. The earheads from B lines be harvested first followed by critical examination of the plot for the presence of any plant or earhead of B lines. The earheads from A lines are then harvested. The threshing, drying, processing and bagging of A and B lines be undertaken separately to constitute the breeder seeds of A and B lines.

Basics of sorghum seed production

Sorghum hybrid seed production is a highly commercial venture, it is essential to maintain high level of crop management in order to maximize production at minimum cost. The guidelines for seed production are:

1. Isolation

The isolation distance for foundation and certified seed production programme is given below:

Table 1. Field standards for foundation and certified seed.

Stage	Isolation in meters	Pollen shedders (%)	Off type	Seed borne disease (%)
Foundation seed				
i. Sorghum hybrids	300+	0.050	0.010	Kernal smut 0.050
	400*			Grain smut 0.050
ii. Open pollinated varieties	200+	-	0.010	Kernal smut 0.050
	400*			Grain smut 0.050
Certified seed				
i. Sorghum hybrids	200+	0.10	0.050	Kernal smut 0.010
	400*			Grain smut 0.010
	25**			
ii. Open pollinated varieties	100+	-	0.050	Kernal smut 0.010
	400*			Grain smut 0.010

+ = Other varieties * = From Johnson and forage types

** = Same variety not conforming to varietal purity for certification

2. Plant height

Plant height differences of males and females and also pose seed production problems especially when male parent to be planted 5-6 days earlier. During summer (Jan-Feb. planting) male should be planted 12 days earlier, than female.

In the case of CSH 5 (2077 A x CS 3541) during *kharif* 6-8 days staggering of male is required (male to be planted late). During *rabi* about 12 days staggering and in summer 30-35 days staggering is required (in both the seasons male to be planted later). *Rabi* and summer production may be avoided as there are pollen dispersal problems with CS 3541.

In case of CSH 9 male parent i.e. CS 3541 should be planted 4-5 days later than female. In Maharashtra, seed production of these hybrids should be undertaken only in *kharif* season.

Because of dessication and viability problems of stigmas and pollen, as far as possible H.W. seed production be avoided. However, if there are good irrigation sources it may be taken up in Deccan planteau

region (traditional *rabi* area) and sowing time so adjusted that flowering takes place in June, so that temperatures are comparatively low weather is cloudy and humid. This will help good seed set.

Most of the parental lines of sorghum hybrids have matching heights in the *rabi* season facilitating easy pollination process. The problem of disparity of heights can be avoided to some extent by planting the short parent on the raised ridges and the taller parent in the furrow below. Selective urea sprays also enables to increase the height of some extent by elongation the peduncle.

3. Nicking/ensuring synchronization

The proper nicking or synchronization of flowering between the two parents is a key to success. The male and female parents of the various hybrids, with different degrees of photo and thermo-sensitivities may react variably under different day length and temperatures.

Several methods are employed to ensure synchrony. The commonly followed technique is staggered planting i.e. adjusting the planting dates of the parents so that they flower simultaneously. If the difference in flowering between the two parents is only 2-4 days, it is possible to maniplute it through selective application of foliar sprays of urea (2 %) to the late parent at flower primodia initiation stage (between 30-40 days after planting) and repeated 3-5 times on alternative days. If the flowering differs between the parents ratooning of the early parent at appropriate time could be followed. In case of failure of synchrony, dusting or spraying of pollen collected from the male parent, if available in the vicinity can be done.

Details of manipulations required for proper nicking/ synchronization are listed below:

- Sowing of the female and the male parent are to be taken up on different dates on experience and recommendation as they differ from region to region depending on temperature and other factors.
- Closely observe the growth and the primordial initiation of both the parents. In case of difference, boost up the parent lagging behind by giving the additional dose of nitrogen application in the soil followed by foliar spraying. In advanced conditions the spray of borax at the emergence of earhead is useful.
- If the male is advanced in the early stage due to adverse seasonal conditions, cut alternate plants to allow the tillers to come up and boost up such tillers with additional dose of nitrogen.
- At the time of flowering, tapping of male lines between 8 to 10 A.M.helps in good seed setting.

- If the pollen is not available in the same plot, collect the pollen in the morning from neighbouring plots and instantly spray with water or dust on the earheads of the female parent.
- If there is dew fall hampering spreading or pollen, blow empty power duster on the male rows to disperse pollen towards female heads or tap the male heads.
- In case of partial seed setting, sugary disease may occur. Spray of thirum/captan to control the disease and avoid prolonged sowings in the same areas is advised since the disease may invade the late sown crop in epiphytotic proportion.
- Don't allow the standing crop to completely dry. Harvest it at the physiological maturity and dry the earheads by spreading in thin layer to avoid mould infestation.
- For good seed setting and avoiding synchronization problems, isolation problems and getting continuous pollen availability from the neighbouring fields it is advisable to organize jowar hybrid seed production in compact areas following seed village approach.

Staggering planting

Table 2. Staggering planting for *kharif* hybrids

Sr. No.	Hybrid	Season	Planting time
1.	CSH 1	***Kharif***	No staggering
		Rabi	Male to be planted 5-6 days earlier
2.	CSH 5	***Kharif***	Male to be planted 6-8 days earlier
		Rabi	Male to be planted 12 days late
3.	CSH 6	***Kharif***	Male to be planted 6-7 days late
		Rabi	Male to be planted 8-10 days late
4.	CSH 9	***Kharif***	Male to be planted 4-5 days late
5.	CSH 13 K	***Kharif***	Male to be planted 6-7 days late
		Rabi	Male to be planted 4-5 days late
6.	CSH 14	***Kharif***	3-4 days differences in flowering can be adjusted by adopting differential fertilization
		Rabi	
7.	CSH 16	***Rabi***	No staggering
8.	CSH 17	***Kharif***	Male to be planted 4-5 days late
9.	CSH 18	***Kharif***	No staggering
10.	CSH-21	***Kharif***	No staggering
11.	CSH-23	***Kharif***	No staggering

Table 3. Staggering for *rabi* hybrids

Sr. No.	Hybrid	Season	Planting time
1.	CSH 13 R	***Kharif***	In Nadhyal Valley of A.P. by adopting 4-6 days staggering of male parent
2.	CSH 15 R	***Rabi***	Female parent to be planted 10 days earlier
3.	CSH 19 R	***Rabi***	Male parent to be planted 2-3 days late

4. Flowering and pollen dispersal

In view of the nicking problem and pollen viability for few hours in morning the longer the duration of flowering in the male line, the better it is for seed set as pollen is available continuously for more number of days. This can be achieved by staggered planting of the two male rows whenever the situation demands. It is not safe to rely entirely on natural winds to aid in pollen dispersal. It is desirable to use artificial aids of pollen dispersal like tapping the male plant or blowing air through empty duster over the male heads. It is also advisable to spray 2 % Borax to improve the pollen production and dispersal. In *kharif* season pollen dispersal is good while in *rabi* and summer artificial aid of pollen dispersal like tapping the male plant or blowing air through empty dusters over the male heads will have to be resorted to. Pollen is viable only for few hours after flower opening, which takes place in early hours and as such dusting, taping will have to be done, during this time.

5. Planting ratio

The most ideal planting ratio is 4;2 while this ratio could be widened to 6:2 in the case of male parent having longer span of flowering. A 5 rows thick border all around the seed production plots must always be provided.

6. Stigma receptivity and pollen production

Generally stigma is receptive for 5 to 7 days after flowering. In some varieties it is still more, upto 10 days or so. However, during hot summer months the receptivity is lost earlier owing to desiccation of stigmas. In winter season due to low temperatures pollen production is also affected. To overcome these difficulties it is necessary to adjust planting times so as to avoid high and low temperatures in different seasons.

7. Roughing

The problems of genetic purity can be solved by adopting timely rouging in the seed plots and maintenance of prescribed isolation distance. The removal of off types and diseased plants from within the seed field before they start flowering is known as rouging. The B line plants in seed parent (cms rows), pollen shedders in seed parent, off types in seed parent and pollinator line must be removed before the anthers start shedding pollen to get pure sorghum hybrid seed. This is done to avoid genetic contamination/out crossing and transmission of seed borne diseases. Scientifically, rouging is the process of negative mass selection in which 'off-types' are removed and only 'on type' plants are retained in the whole population of a seed crop. The rouging should be continuously practiced both in self and cross pollinated crops and must be completed well before the flowering i.e. when anthers start shedding pollen and thus become the source of contamination. In hybrid seed production this operation is to be carried out individually in seed and pollen rows.

Agronomic management practices

Choice of field, area, season and source of seed are important criteria to start with. The field should not have sorghum as preceding crop. General guidelines should be followed for growing uniform and healthy crop.

1. Climate

The site of seed production should have assured rainfed or irrigation facilities, 30-35 ^{0}C temps. with relative humidity of 70-80 per cent at flowering and dry weather at harvest.

2. Land

The land should be medium to deep black with good drainage. The land should not be previously grown sorghum crop.

3. Preparatory tillage

One or two ploughing and 2 to 3 harrowing are sufficient. Before last harrowing 15-20 cartload of FYM should be applied.

4. Seed

i. For open pollinated variety seed rate of 10-12 kg/ha be adopted.

ii. Incase of parental lines 7 to 8 kg/ha seed of 'A' line and 5-6 kg/ha of 'B' or 'R' line is required.

5. Sowing

Prepared the land in summer season and keep it weed free. Timely sowing is very much important in both the seasons. For *kharif* season complete the sowing in last week of June to first week of July. The sowing should not be delayed beyond the first week of July. Sowing of seed production may be completed from 15th September to first week of October. Seed must be sown at 45 cm (18"0 row spacing, hand dibbling on ridges and furrows. Seedling should be thinned out after two week of sowing to maintain a distance of 15 cm (6") between each plant. For production of 'A' line seed, a separate crossing block has to be established by growing alternative 4 lines of 'A' on 2 lines of 'B' line (Maintainer-pollen producer). Similarly 'R' line has to be multiplied separately. Certified seed of hybrid is produced by putting alternatively 'A' and 'R' lines, ratio being 4:2.

6. Fertilizers

Application of 120:60:60 kg/ha N, P, K per hectare is recommended. Out of this 60:60:60 kg/ha given as basal dose and remaining 60 kg N be applied as top dressing one month after sowing.

7. Plant protection measures

For control of shoot fly spray of quinalphos 35 EC @ 0.05 % i.e. 15 ml in 10 liter of water be used. Such 2 to 3 sprays are required for maintaining plant population.

Ergot or sugary disease is common on male sterile lines and its severity is more in cool temp. (min. 19 ^{0}C) combined with high humidity. For its control spraying of 0.2 % Thirum or 0.1 % Benlate immediately after initiation of flowering and two additional sprays of 5 days interval reduces to infection. Seed treatment with 300 mesh sulphur (@ 1 kg seed/4 gm sulphur) or captan (1 kg seed/3 gm captan) can effectively controlled the grain and loose smut.

Charcoal rot can be reduced by proper soil management practices to conserve moisture. Leaf spot such as rust can be controlled by spraying Dithane M-45 @ 3 % concentration.

Harvesting and post harvest handling of seed crop

Supervised harvesting and after care during post harvest handling of seed crops is an integral part of certification scheme. The time, energy and money spent in growing genetically and disease free seed crops may go waste if the harvested seed crops are left to the vagaries of weather conditions or if steps are not taken to complete its processing such as threshing and winnowing, drying, cleaning, grading, seed treatment, packing, labeling and sealing and later movement of the seed lots for safe storage.

a. Harvesting and threshing

Harvesting should be done separately for 'A' line and 'B' or 'R' line, when weather is dry. Seed on attaining physiological maturity in the field should be harvested since by then it acquires the highest degree of vigour and viability which may gradually decline with the delay in harvest at the field maturity. The ear heads should be dried promptly as moisture content is the important aspect to influence the keeping quality.

b. Drying

Seed produce after harvesting and threshing is subject to sun drying to reduce the moisture content below 9 % at the production site itself before transporting it to the processing plant.

c. Processing, Bagging, Tagging and Labeling

i. In most of the cases, insect infestation starts when the seeds are kept in preprocessing shed. Delay in processing and subsequent storage damage the seed. In case of insect infestation seed should be fumigated with aluminium phosphide @ 2 tablets of 3 g each per tonne with an exposure period of 3-5 days.

ii. Moisture content of the seed to be fumigated should not be more than 12 %, it also kills larvae in case of internal feeders.

iii. Processed seed may be treated with malathion 5 % dust (premium grade) @ 0.6 g per kg seed. In no case insecticide treated seed should be disposed off for food or feed purpose.

iv. Food seed storage, preferably new bags should be used to avoid insect infestation and mechanical mixture. If old bags are used,

they must be thoroughly cleaned and treated with either malathion spray or fumigant like ethylene dibromide (EDB) @W 32 mg/1 or aluminum phosphide @ 1 tablet of 3 g per in space with an exposure period of 3-5 days in air tight conditions.

v. Processed seed should be stored properly and must not be kept in an area where unprocessed or carryover seeds are kept.

d. Seed standards:

Table 4. Seed standards for foundation and certified seeds

Factor	**Standards for each class**	
	Foundation	**Certified**
Pure seed (min.)	98.0 %	98.0 %
Inert matter (max.)	2 %	2 %
Other crop seeds (max.)	5 /kg	0.10 %
Weed seed (max.)	5/kg	0.10 %
Germination (min.)	80 %	80 %
Moisture (max.)	12 %	12 %

e. Care during storage

Seed should be inspected at fortnightly interval. In the event of detection any insect infestation, seed must be fumigated under air tight condition with any one of the following fumigants.

i. Aluminum phosphide: 2-3 tablets of 3 g each per tonne of material with an exposure period of 3-5 days or 1 tablet per m space.

ii. Ethylene dibromide (EDB) 32 g per m space with exposure period of 5-7 days.

f. Guideline for storing seeds for longer duration

Special condition is to be created for storing seeds for 5 years or more. Normally, this can be achieved by controlling storage temp. and relative humidity of the store.

Table 5. Suggested conditions for storing seeds for longer duration

Duration of storage (year)	Temp. (^0C)	Relative humidity (%)
5-7	15-20	45-50
20-25	2-4	40-45
50 or more	-10	40-45

Seed Certification

To ensure and exercise this control, seed certification is necessary. Seed certification is the process designed to secure, maintain and make available high quality seed and propagating materials of superior crop plant varieties, so grown and distributed as to ensure desirable standards of genetic identity, physical purity and other quality attributes. Certification is performed in five phases.

i. Verification of land requirements.
ii. Verification of seed source.
iii. Inspection of the seed crop in the field.
iv. Inspection and testing of each seed lot and seed sample during the processing and bagging and
v. Tagging, labeling and sealing to identify the seed.

Why Inspection is Necessary?

The primary objective of conducting field inspections is to confirm that seed produced from a crop grown for seed purpose is of the designated variety and that it has been contaminated genetically and/or physically beyond certain specified limits.

The objective of field inspection is fulfilled by verifying that the seed crop is

- Grown on a field which satifies the prescribed land requirements.
- Raised from seed whose source is approved?
- Provided with the prescribed isolation and/or with the prescribed number of border rows in hybrid seed production.
- Planted in the prescribed ratios of female (seed) and male (pollinator) parents in the case of hybrid seed production.
- Properly roughed to remove contaminating factors such as plants/ears, objectionable weeds and other crop plants so as to confirm to the standards prescribed for these factors.
- True to the cultivar characteristics descriptive of that cultivar.
- Harvested properly to avoid mechanical admixture.

❖ Grown in compliance with other special requirements for crop concerned.

The salient morphological features of different hybrids and their parental lines as a ready reckoner is given in Table 6 to aid seed growers and personnel involved in seed certification.

Table 6. Morphological Description of Parental Lines of Released *Rabi* Hybrids

	CSH 13 R		**CSH 15 R**	
Year of release	1991		1995	
Parantage	296 A	RS 29	104 A	RS 585
Plant colour	Tan	Tan	Purple	Purple
Leaf colour	Light green	Green	Dark green	Green
Leaf position	Dropping	Dropping	Erect	Drooping
Leaf midrib colour	Colourless	Dull green	White	Dull
Stem thickness	Thick	Medium	Medium	Thin
E.H. Exertion	Exserted boot leaf touching base of earhead	Well exserted	Exserted boot leaf touching base of earhead	Exserted
Compactness	Semi-compact	Semi-compact	Semi-compact	Semi-compact
Earhed shape	Elliptical	Oval	Cylindrical	Ovate
Glume colour	Straw	Straw/ Red	Brown with reddish base	Straw
Seed colour	White	Creamy	Creamy	Pearly white
Size	Medium	Medium	Bold	Bold
Shape		Round		Round
Endosperm colour	Yellow	Light yellow	Yellow	-
Plant height (cm)	120-130	150-180	130	167
Days to 50 % Flowering	K : 65-75 R : 75-85	K : 73-78 R : 70-80	K : - R : 79-81	72
Photosensitivity	Medium	Moderate insensitive	Sensitive	Insensitive
Threshability	Free threshable	Free threshable	Free threshing	Free threshing

	CSH 19 R	
Year of release	2004	
Parantage	104 A	AKR-354
Plant colour	Purple	Purple
Leaf colour	Dark green	Green
Leaf position	Erect	Erect
Leaf midrib colour	White	Green
Stem thickness	Medium	Thick
E.H. Exertion	Exserted boot leaf touching base of earhead	Exertion just neck
Compactness	Semi-compact	Semi-compact
Earhed shape	Cylindrical	Cylindrical
Glume colour	Brown with reddish base	Reddish
Seed colour	Creamy	Creamy
Size	Bold	Medium bold
Shape	Round	Round
Endosperm colour	Yellow	Yellow
Plant height (cm)	130	180-190
Days to 50 % Flowering	K : - R : 79-81	74
Photosensitivity	Sensitive	Sensitive
Threshability	Free threshing	Free

Table 7. Characteristics of hybrids for *Rabi* season

Season	Pedigree	Days to 50 % flow.	Days to maturity	Plant characteristics	Yield (q/ha)		Area of adoption
					Grain	Fodder	
CSH 13 R	296 A x RS 29	68-70	110-115	Height 190-210 cm, turtle beak grain, semi compact earhead	35-40	95-100	Dry Irrigated area of M.S., Karnataka, Entire *rabi* area of Gujrath, late *rabi* of A.P.
CSH 15 R	104 A x RS 585	72-75	115-120	Height 190-210 cm, earhead cylindrical, glume light brown to straw colour, pearly white grain colour and bold	28-30	50-60	Rainfed and irrigated area of Maharashtra, Karnataka and A.P.
CSH 19 R	104 A x AKR 354	70-75	115-120	Height 225-230 cm, glume straw coloured, panicle medium	38-40	70-75	Rainfed and irrigated area of Maharashtra, Karnataka and A.P.

Table 8. Morphological characters of released *kharif* sweet sorghum varieties and forage sorghum varieties

Sr. No.	Characters	*Kharif* sweet sorghum varieties			Forage sorghum variety P. Amruta
		SSV 84	CSV 19SS	CSH 22SS	
1.	Year	1990	2004	2004	2003
2.	Pedigree	Sel. From IS 23568	RSSV-2 x SPV 462	ICSA 38 A x SSV 84	RSSV-2 x SPV 462
3.	Pigment	Tan	Non-tan	Non-tan	Non-tan
4.	Plant height (cm)	210-230	220-240	260-280	220-240
5.	Days to 50 % flowering	80-85	76-80	82-85	76-80
6.	Days to maturity	120-125	115-120	120-125	115-120
7.	No. of internode	9-10	11-14	11-14	11-14
8.	Colour of leaves	Green	Green	Green	Green
9.	Midrib colour	Green	Dull green	Green	Dull green
10.	Canopy shape	Semi- dropping	Semi-dropping	Semi-dropping	Semi-dropping
11.	Panicle shape	Oval	Oval	Cylindrical	Oval
12.	Earhead compactness	Semi-compact	Semi-compact	Semi-compact	Semi-compact
13.	Glume colour	Straw	Straw	Straw	Straw
14.	Threshing	Free	Free	Free	Free
15.	Seed size	Medium bold	Medium bold	Medium bold	Medium bold
16.	Seed colour	White	White	White	White
17.	Seed shape	Turtle	Round	Round	Round
18.	Grain yield (q/ha)	10-12	8-10	10-15	8-10
19.	Green cane yield (q/ha)	30-35	35-40	40-45	50-60 (Green forage)
20.	Recovered conditions	For alternative uses like syrup/ jaggery/ ethanol	For alternative uses like syrup/ jaggery/ ethanol	For alternative uses like syrup/ jaggery/ ethanol	For single cut forage during *kharif* season

Table 9.Morphological characters of *rabi* sorghum varieties developed at sorghum Improvement Project, MPKV, Rahuri.

Sr. No	Characters	M 35-1	Swati	Sel. 3	Phule Yashoda	Phule Maulee	P. Uttara (Hurda)	Phule Chitra	Phule Vasudha	CSV 22 (SPV1626)	Phule Anuradha	Phule Revati	Phule Panchami	Phule Suchitra
1	Year of release	1938	1984	1994	1998	1999	2005	2006	2007	2007	2008	2010	2010	2011
2	Pedigree	Sel from maldandi population	SPV 86 x M 35-1	Sel from local bedar	Sel from local land races	Sel from local germplasm	Sel from local germplasm	SPV 655x RSLG 112	RSLG 206 x SPV 1047	SPV 1359 x RSP 2	RSLG 559 x RSLG 1175	CSV 216 x SPV 502	Local land races	SPV 1359 X SPV 1502
3	NBPGR National Identify Number	IC 55394	IC 553440	IC 553441	2000/52	IC 296365	IC 523096	IC 523095	IC 552391	IC 552490	IC 552492	IC 573125	IC 573124	-
4	Notification Number	S.O.596 (E)dt 13/8/84	S.O. 540 (E) dt. 24/7/85	S.O.1(E) dt 1/1/96	S.O.82 (E) dt 13/9/2000	S.O.82 (E) dt 13/9/2000	S.O122 (E) dt 6/2/2007	S.O72 E (E) dt 10/1/08	S.O72 E (E) dt 10/1/08	S.O1709 (E) dt 5/10/2007	Submitted	Yet to be submitted	Yet to be submitted	-
5	Pigment	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
6	Days to 50% flow.	74-78	74-78	68-72	80-85	71-73	70-72	74-76	74-78	76-80	68-72	76-80	76-78	78-80
	Days to Maturity	120-125	120-125	110-115	120-125	110-112	110-114	118-120	116-120	118-122	105-110	118-112	118-120	120-125
7	Plant height (cm)	180-200	180-190	160-170	240-270	180-210	160-180	200-220	180-210	180-210	160-170	210-240	175-210	230-240
8	Leaf length (cm)	50-60	55-60	35-40	68-74	51-55	55-62	50-60	60-65	55-60	35-38	65-70	60-65	60-65
9	Leaf Orientation	Semi dropping	Semi dropping	Semi dropping	Semi dropping	Semi dropping	Semi dropping	Semi dropping	Semi dropping	Semi dropping	Semi dropping	Semi dropping	Semi dropping	Semi dropping
10	Leaf midrib colour	Dull green	Green	Green	White	Yellowish	Green	White	White	White	Green	White	White	White
11	Earhead shape & compactness	Oval & semi compact	Oblong Semi compact	Oval & Semi compact	Cylindrical & Semi compact	Elliptical oval & Semi compact	Oval & Semi compact	Elliptical oval & Semi compact	Cylindrical & Semi compact	Cylindrical & Semi compact	Oval & Semi compact	Cylindrical & Semi compact	Oval & Semi compact	Elliptic ovate
12	Glume pigment	Straw	Straw	Red	Straw	Straw	Red	Straw	Straw	Straw	Reddish	Straw	White	Straw
13	Seed size, shape & colour	Round, bold & Pearly white	Round, bold & Yallowish	Round, Medium bold & Pearly	Medium bold, Pearly white	Medium bold, Creamy	Medium Sub-lenticular	Medium bold, Pearly white	Medium bold, Pearly white	Medium bold, Pearly white	Round, bold & Pearly White	Round, bold & Pearly White	Round and white chalky	Round, bold & Pearly White
14	Reaction to pest	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant
15	Reaction to disease	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant
16	Reaction to stress	Tolerant	-	Tolerant	-	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	Tolerant	-		-
17	Grain yield (q/ha)	15-18	24-28	5-6	25-30	15-18	10-12	20-25	25-28	24-28	8-10	40-45	12-14	20-25
18	Fodder yield (t/ha)	50-60	50-60	15-18	70-78	45-50	50-55	55-60	55-60	65-70	30-35	90-110	40-45	65-70
19	Recommended soil type	Medium soil	Deep soil	Shallow soil	Deep soil	Medium soil	Medium to deep	Medium soil	Deep soil	Deep Soil	Shallow soil	Irrigated & M-Deep soil	Medium-deep	Medium Deep soil

Farmer's trainings and rallies organized under CRP-Seed Project during 2018-2019

Farmers rally is very important weapon to disseminate new technology on large scale at a time as well as to show the demo crop lots on the training farm. During farmers rallies farmers expressed their experiences about sorghum crop cultivation and expected outcome. Various disciplines scientists also participated for discussion and solving various issues related to sorghum crop. Farmer's rallies were organized at different villages before sowing the crop; during crop growth and at the crop harvesting and scientists also demonstrated how to make harvesting effectively and how to preserve these seeds for the next year. Universities higher authorities also actively participated and guided to the farmers.

During 2018-2019 *rabi* season various dignitaries of ICAR, ICRISAT, State Government of Maharashtra, Central Government of India and Some Scientists from Abroad, other scientists and farmers from Maharashtra as well as from other States of India also visited the Sorghum crop demos' plots at Sorghum Improvement Project, MPKV, Rahuri and Farmer's field at Kambi, Hatgaon and Narayanwadi villages of Ahmednagar district.

Farmers rally at Sorghum Project, MPKV, Rahuri, Dist. Ahmednagar CRP-Seed Project

Farmers rally at Sorghum Project, MPKV, Rahuri, Dist. Ahmednagar CRP-Seed Project

Farmers rally at Sorghum Project, MPKV, Rahuri, Dist. Ahmednagar CRP-Seed Project

Farmers rally at Sorghum Project, MPKV, Rahuri, Dist. Ahmednagar CRP-Seed Project

News and articles in local language (Marathi) for dissemination of seed production of improved *rabi* sorghum varieties on the farmers field through implementing CRP-Seed Project at three Districts (Ahmednagar, Pune and Solapur) of Maharashtra State.

For awareness and recent information dissemination among the farmers the news and articles as well as flyers on sorghum crop at various crop growth stages were published in local daily news papers in local language in all three districts (Ahmednagar, Pune and Solapur) of Maharashtra. Flyer on improved cultivars of sorghum and their cultivation technology, seed production technology, storage and record keeping, soil testing and their importance, grain and fodder value addition as well as marketing of the sorghum produce were prepared and circulated among farmers, consumers and traders. Due to this activity large numbers of farmers were benefited for getting advanced information on sorghum crop cultivation in time. The scientists working on sorghum crop found very good impact of this mass media for information dissemination very quickly and effectively.

Tentative Programme of CRP-Seed Production under MPKV, Rahuri Jurisdiction during 2018-2019

Sr. No.	Name of area/region	Area (ha)	Variety
I.	**Ahmednagar**		**Phule Anuradha, Phule Suchitra, Phule Vasudha, Phule Revati** as per the soil type in each village.
	Ahmednagar	100	
	Pathardi	100	------- do ------
	Karjat	150	------- do ------
	Shrirampur	100	------- do ------
	Rahuri	90	------- do ------
	Newasa	300	------- do ------
	Kopargaon	80	------- do ------
	Shewagaon	180	------- do ------
	Rahata	200	------- do ------
	Jamkhed	100	------- do ------
	Total	**1400**	
II.	**Sholapur**	**200**	------- do ------
III.	**Pune**	**60**	------- do ------
	Grand Total	**1660**	

CRP-Seed Project Results of the *Rabi* Sorghum Seed Production during 2018-2019

Sr. No.	Region/Cluster	Variety	Area (ha)	Growers	Raw seed (q)
	Ahmednagar (Newasa+Shevgaon)	Phule Anuradha	-	-	-
		Phule Suchitra	10.40	01	14.45
		Phule Vasudha	38.60	22	216.99
		Phule Revati	45.80	33	656.92
		Total	**94.80**	**56**	**888.36**
2.	Pune (Shirur)	Phule Anuradha	-	-	-
		Phule Suchitra	3.30	1	15.95
		Phule Vasudha	-	-	-
		Phule Revati	-	-	-
		Total	**3.30**	**1**	**15.95**
3.	Sholapur	Phule Anuradha	**-**	**-**	**-**
		Phule Suchitra	**-**	**-**	**-**
		Phule Vasudha	-	-	-
		Phule Revati	05.00	5	23.87
		M 35-1	-	-	-
		Parbhani Moti	-	-	-
		Total	**05.00**	**5**	**23.87**
		Gross Total	**103.10**	**62**	**928.18**

Rabi Sorghum Breeder, Foundation and Truthful Seed Production-2018-19

Sr. No.	Name of variety	Area (ha)	Raw Seed (q)
A.	**Breeder Seed**		
1.	Phule Chitra	-	-
2.	Phule Amrutha	0.01	0.10
3.	Phule Anuradha	0.40	2.10
4.	Phule Panchami	0.05	1.00
5.	Phule Yashoda	0.02	0.20
6.	Phule Ruchira	0.10	0.10
7.	Phule Revati	3.40	37.00
8.	Phule Vasudha	0.80	7.00
9.	CSV 30F (Fodder)	0.40	4.00
10.	Phule Suchitra	3.40	28.00
11.	RPASV- 3 (Phule Rohini)	0.20	0.00
12.	RSSGV- 46 (Phule Madhur)	0.20	2.00
13.	RSSH-50 (Phule Vasundhara) 185 A Line 185 B Line RSSV 260 R Line	 0.20 0.02 0.02	 0.20 0.20 0.20
14.	CSV-22	-	-
	Total	**9.22**	**82.1**
B.	**Foundation Seed**		
1.	Phule Anuradha	0.40	2.10
2.	Phule Revati	5.00	50.00
3.	Phule Vasudha	4.00	80.00
4.	Phule Suchitra	3.00	25.00
	Total	**12.40**	**157.10**

C	**Certified seed**		
1.	Phule Anuradha	0.40	2.10
2.	Phule Revati	9.00	81.60
3.	Phule Suchitra	5.00	45.00
4.	Phule Vasudha	5.00	100.00
	Total	**19.40**	**228.7**
D	**Truthful seed**		
1.	Phule Ruchira	0.80	6.00
2.	CSV-30F (Fodder)	1.00	23.00
3.	Phule Suchitra	-	-
4.	RSSGV- 46 (Phule Madhur)	0.50	2.00
5.	Phule Amrutha	-	-
6.	Phule Revati	-	-
7.	Phule Vasudha	-	-
8.	Phule Anuradha	0.80	7.50
9.	RSSH-50 (Phule Vasundhara)	0.20	1.00
10.	Phule Panchami	0.20	0.20
11.	Phule Rohini (RPASV-3)	0.10	0.50
12.	Phule Madhur (RSSGV-46)	0.50	2.00
	Total	**4.10**	**42.2**
	Grand Total (A+B+C+D)	**45.12**	**510.1**

Weekly meteorological data 2018

Location: MPKV, Rahuri ; Month :Jan 2018 to December, 2018 : State Maharashtra.
Latitude :**19^0.24 N** ; Longitude :**74^0.39 E** ; Altitude **: 657 mts.** (above MSL) Year 2018

Sorghum Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri.

Week No.	Date	Temperature		Humidity (%)		Wind Velocity (KM/hr)	Sunshine Hours	Rainfall (mm)	Rainy Days	Evaporation (mm)
		Max	Min	Morn (I)	Even (II)					
1	Jan. 1-7	28.4	10.6	67	36	00.2	07.9			0.38
2	8-14	25.1	12.2	63	35	00.3	07.5			0.39
3	15-21	29.9	12.8	70	32	00.5	08.6			04.4
4	22-28	28.4	09.5	55	27	00.5	09.4			04.8
5	29-4	30.3	10.6	59	21	00.7	09.5			05.0
6	Feb. 5-11	31.2	13.8	53	23	01.3	07.4			05.0
7	12-18	30.4	13.5	66	34	00.8	09.0			05.3
8	19-25	33.7	15.0	53	24	00.7	08.0			06.0
9	26-4	34.6	17.0	49	20	01.1	08.5			06.6
10	Mar. 5-11	34.6	18.2	44	20	01.4	07.4			05.9
11	12-18	33.1	18.9	48	25	01.4	05.9			07.0
12	19-25	35.0	16.4	44	19	01.9	08.8			07.2
13	26-1	37.6	18.0	40	15	01.9	09.2			08.5
14	Apr. 2-8	37.5	19.8	40	19	01.8	07.9			07.5
15	9-15	37.2	20.0	44	19	01.6	08.8			08.4
16	16-22	39.3	22.3	41	21	03.6	10.0			10.4
17	23-29	39.4	19.7	30	13	02.2	10.8			13.0
18	30-6	40.6	21.0	36	17	03.9	10.6			14.3
19	May 7-13	40.2	24.2	32	18	04.1	10.3			13.8
20	14-20	39.8	24.3	36	19	04.8	09.8			13.6
21	21-27	38.8	25.2	40	20	04.5	07.1			09.5
22	28-3	38.8	24.7	64	34	04.4	07.8	38.00	2	07.8
23	Jun. 4-10	34.2	24.6	72	47	03.7	03.8	8.8	2	04.8
24	11-17	35.3	25.0	62	42	11.6	07.8			0.60
25	18-24	34.1	23.4	72	54	04.9	04.8	23.4	1	05.3
26	25-1	32.1	23.0	73	53	07.7	03.9	22.8	1	05.0
27	Jul. 2-8	31.7	23.3	76	59	08.0	00.3	74.8	2	05.3
28	9-15	28.2	22.8	80	70	05.0	01.8	7.00	2	03.4
29	16-22	29.4	23.0	77	65	08.7	01.3	4.0	1	04.1
30	23-29	28.6	22.7	75	62	07.5	01.3			04.1
31	30-5	31.3	23.3	72	53	07.9	04.0			05.4
32	Aug.6-12	30.0	23.0	75	62	06.8	01.5			05.1
33	13-19	27.8	22.5	81	73	04.8	00.6	67.00	1	03.6
34	20-26	27.9	21.5	80	70	05.0	03.0	23.4	2	03.7
35	27-2	29.6	21.1	75	61	03.5	05.0	6.0	1	04.4
36	Sept. 3-9	30.1	19.6	70	59	04.1	05.8			05.1
37	10-16	32.4	19.5	69	49	00.8	07.6	11.00	1	05.5
38	17-23	31.9	22.1	71	45	02.7	06.1			05.5
39	24-30	33.8	22.3	71	44	01.3	08.1			06.3
40	Oct. 1-7	34.0	21.5	67	43	01.3	07.8	6.2	1	06.3
41	8-14	34.0	18.4	55	30	01.6	08.8			07.0
42	15-21	33.5	18.6	50	30	01.3	08.2			06.6
43	22-28	34.4	16.8	46	30	01.0	08.5			06.6
44	29-4	31.7	14.4	58	39	01.9	09.4			06.5
45	Nov.5-11	33.1	16.8	59	37	0.8	08.1			06.4

46	12-18	32.5	12.9	43	23	0.8	9.9			05.9
47	19-25	31.7	16.3	61	46	1.3	7.7			05.7
48	26-2	30.1	11.3	58	32	0.8	9.2			05.6
49	Dec. 3-9	30.3	15.0	60	35	01.5	06.6			04.9
50	10-16	28.1	11.3	55	35	00.7	05.6			04.9
51	17-23	26.5	9.1	64	36	00.5	09.1			04.4
52	24-31	27.8	8.9	51	30	00.6	08.8			04.6