

# Nimbkar Agricultural Research Institute (NARI), Phaltan

## ANNUAL RESEARCH REPORT 2007-2008

### *Report of the President*



Safflower is one of mankind's oldest crops, but has remained a minor oilseed crop with declining area and production during last 10-15 years. Over 60 countries grow safflower. India still has about 50% of the area, but only a quarter of the production. NARI has been working on safflower for last 40 years and we feel that the important contribution this crop can make to human nutrition and medicine needs to be recognized to increase its popularity. For this reason we have been test-marketing safflower flowers as herbal health tea for many years and are seeking funding for a project to "commercialize safflower flowers to raise socio-economic status of farmers in rainfed areas of Maharashtra". We firmly believe that safflower can become remunerative only if it is exploited for its flowers in addition to the seeds.

I wish to congratulate Dr. Vrijendra Singh and his team for the development of NARI-38, a spiny wilt-resistant safflower variety. NARI-38 was released and notified for commercial production under limited irrigation conditions in safflower growing areas of India. This is the fifth safflower cultivar released from NARI.

In November of last year Dr. Anil K. Rajvanshi was invited to China as a UN expert to advise the office of National Energy Leading Group which is under the chairmanship of the Chinese prime minister. This was a great honour and the institute is really proud of his achievements. He was the only Asian invited and was also the keynote speaker at the international conference on China Rural Energy Development. Due to his deep study of the topic "Sustainable Energy for Rural Development" he was also invited by many institutions all over India throughout the year to talk to them.

Another highlight of the past year was the release in Pune of Dr. Anil K. Rajvanshi's book entitled "[1970s America – An Indian Students Journey](#)" at the hands of well-known industrialists Shri. Baba Kalyani and Shri. Madhur Bajaj. Shri. Rakesh Sharma, Commissioner of Customs and Excise also graced the occasion in May 2008.

I would finally like to congratulate Dr. Chanda Nimbkar and the staff of animal husbandry division for getting the prestigious "CSIR Award for S&T Innovations for Rural Development (CAIRD)" for NARI. This award for 2007 was given to NARI and NCL, Pune jointly with NRC-Yak for "Use of FecB gene in Deccani breed of sheep, to increase lamb production and thereby the incomes of shepherds". More information on the progress of this project at NARI can be read in this report.

I wish to also thank Dr. Anil K. Rajvanshi, Mr. B. V. Nimbkar, Mr. K. Subramanya, Mr. Abhay Vaidya, Mrs. Hemlata Rajvanshi and Mrs. Primla Vohra for their donations of about Rs. 3,25,000/- to the corpus during the year. They are very much appreciated.

*Dr. N. Nimbkar*

Phaltan, August 2, 2008

## AGRICULTURAL RESEARCH

### SAFFLOWER

**Project 1:** All India Coordinated Research Project on Oilseeds (Safflower)

**Funding Agency:** Indian Council of Agricultural Research (ICAR), New Delhi

NARI is one of the All India Coordinated Research Project (AICRP) centers of safflower research for limited irrigation since 1980. The major objectives of safflower improvement at NARI have been to develop high-yielding and high oil-producing spiny and non-spiny varieties and hybrids with in-built resistance to wilt (*Fusarium oxysporum*), in addition to development of suitable agro-production technology for safflower under limited irrigation conditions.

The major findings of safflower research carried out under the AICRP during 2007-08 are as follows:

1. **Release and notification of wilt-resistant safflower variety NARI-38:** The spiny safflower variety NARI-38 developed at the center was released and notified by “Central Sub Committee on Crop Standards, Notification and Release of Varieties” for commercial production in all safflower growing areas under limited irrigated conditions in the country during 2007-08. NARI-38 gives an average seed yield of 2038 kg/ha and oil yield of 534 kg/ha and has outyielded the national check A-1 by 9.5% for seed yield and by 15.4% for oil yield. NARI-38 has very high resistance to wilt caused by *Fusarium oxysporum*.
2. **Breeding for wilt resistance in safflower:** Safflower wilt is one of the major diseases of irrigated safflower and is the major bottleneck in producing safflower in the wilt-affected areas. Therefore a breeding programme to transfer wilt resistance from a stable source identified in the AICRP programme into a high-yielding but wilt-susceptible cultivar Nira was initiated at the center by adopting the backcross method of breeding. During winter 2007-08, two trials of BC<sub>4</sub>F<sub>7</sub> generation were carried out on black cotton (Chromustert) soil to identify the genotypes giving high seed yield. Out of the 49 lines evaluated, 19 entries recorded higher seed yield than the best check A-1.
3. **Development of cytoplasmic male sterility system through interspecific crossing:**



The development of cytoplasmic male sterility in safflower through interspecific crossing is being carried out at the Institute. In order to identify a suitable maintainer to the male sterile cytoplasm, the male sterile plants of different crosses were subjected to crossing with sib-pollinator parents which had expressed > 70% male sterility in their progenies in winter 2006-07. About 354 pairwise crosses made with sib-pollinator parents were evaluated during winter 2007-08 to identify the genotypes maintaining male sterility in the sterile cytoplasm. None of the 354 individual crosses evaluated gave 100% male sterility to the sterile cytoplasm.

4. **Evaluation of thermosensitive genetic male sterility system in safflower:** The thermosensitive genetic male sterility system developed at the center was also evaluated during winter 2007-08 to assess its stability over the years. About 538 individual selections were raised during the season. Out of them 205 lines exhibited 100% male sterility in them. The lines showing complete male sterility in winter 2007-08 were planted in summer 2008 for further maintenance and use in hybrid development.
5. **Evaluation of TGMS and CMS lines under multi-environments:** Twenty TGMS lines and 30 CMS lines were evaluated at Phaltan, Indore and Mauranipur during winter 2007-08 to assess their behavior and stability under varied environmental conditions. TGMS lines NARI-1, NARI-2, NARI-3, NARI-5 and NARI-18 exhibited 100% male sterility at all the three locations except NARI-2, NARI-3 and NARI-18 at Phaltan where they expressed percent male sterility slightly less than the 100% anticipated.

Multilocation evaluation of CMS lines showed that the expression of male sterility at Phaltan was lower than that recorded at Indore and Mauranipur. This seems to have arisen due to varied reaction of male sterile cytoplasm to the different environments especially the prevailing minimum and maximum day temperatures, suggesting thereby the role of environment in expression of cytoplasmic male sterility in safflower. Most of the CMS lines except the few evaluated at Indore recorded 70-80% male sterility. The male sterile lines exhibiting 90% or higher male sterility at Indore were NARI-21 (93%), NARI-42 (90%), NARI-46 (93%), NARI-48 (92%) and NARI-49 (95%). At Mauranipur out of the 30 CMS lines evaluated 16 showed 100% male sterility.

6. **Evaluation of thermosensitive genetic male sterility (TGMS)-based hybrids in safflower:** Evaluation of TGMS-based hybrids for sterility under rainfed and irrigated conditions during flowering of the crop showed that all the hybrids were completely fertile, indicating thereby the usefulness of TGMS system for hybrid development in safflower. The evaluation of the TGMS hybrids under rainfed conditions revealed that the hybrid TGMS-H-42 recorded the significantly highest seed yield of 2436 kg/ha and oil yield of 729 kg/ha which were 44.74% and 55.27% higher respectively than those of CMS hybrid check MRSA-521. The other hybrids in the trial recording significantly higher seed and oil yield respectively than MRSA-521 were TGMS-H-39 (2334 kg/ha, 720 kg/ha), TGMS-H-38 (2331 kg/ha, 709 kg/ha) and TGMS-H-41 (2207 kg/ha, 663 kg/ha). The performance of the TGMS-hybrids screened under irrigated conditions showed that the hybrid TGMS-H-31 recorded the highest seed yield of 3723 kg/ha and oil yield of 1193 kg/ha which were 23.60% and 60.35% higher respectively than those of MRSA-521. It was on par with TGMS-H-59 (3424 kg/ha, 1073 kg/ha). The hybrid TGMS-H-38 performed well under both irrigated and rainfed conditions and was followed by hybrid TGMS-H-23 and TGMS-H-54.



**Project 2:** To study origin of seeds with twin embryos and of fused multiple seeds, their inheritance and relationship with possible existence of polyembryony and/or apomixis in safflower

**Funding Agency:** Indian Council of Agricultural Research (ICAR), New Delhi

**Duration:** 1/2/2005 to 31/1/2008

The investigations undertaken in the project have been successful in achieving the objectives proposed in the study. The major achievements of the scheme are described below :

- 1) Embryological investigations of normal sexual genotypes and the genotypes exhibiting apomictic traits were carried out in order to study the origin of seeds with twin embryos and of fused multiple seeds of different genotypes. The embryological studies in genotype 238-14-2 and of fasciated derivatives of an interspecific cross between *C. palaestinus* and *C. tinctorius* indicated the presence of apomictic (aposporous) embryo development in safflower. The histological study of F<sub>1</sub>s from crosses made between fasciated plants and normal sexual genotypes showed single pistils with unilocular ovaries having a single anatropous ovule. Also the process of megasporogenesis to form linear tetrads was found to be normal. This reveals the recessive nature of apomixis-indicating traits in the present case in safflower. However few F<sub>1</sub> progenies of crosses made between genotype 238-14-2 used as female parent and normal sexual genotypes as male parent showed the presence of maternal types in them confirming thereby the occurrence of apomixis in 238-14-2.
- 2) In order to determine the ploidy level to confirm the existence of polyembryony and/or apomixis in twin-embryo seeds of fasciated derivatives of an interspecific cross *C. palaestinus* X *C. tinctorius* and in genotype 238-14-2 identified at the center, the radicles originating from their twin-embryo seeds were studied. The mitotic investigations of radicles of 238-14-2 revealed the presence of 2n=24+2 chromosomes in them indicating the presence of aneuploids. Normal single embryo seeds showed the presence of 2n=24 chromosomes in them. In some cases, the presence of tetraploids (2n=48) was also observed which indicated the tendency of this genotype to show hyperploids suggesting the presence of polyploidy and the possibility of apomictic origin of seeds in it. Meiotic studies to identify the plants with changed ploidy level were also carried out in the fasciated derivatives of an interspecific cross between *C. palaestinus* and *C. tinctorius*. The meiotic studies showed normal pairing of chromosomes at metaphase and the presence of 12 bi-valents both at metaphase and diakinesis. In addition, at anaphase-I, equal distribution of chromosomes at both the poles with no laggards was observed. Meiotic studies in 238-14-2 and D-149 also showed normal chromosome configuration at metaphase and anaphase-I with absence of laggards. Meiotic studies carried out in F<sub>1</sub> crosses made between apomixis-indicating genotypes and normal sexual safflower genotypes with dominant traits therefore showed normal meiotic behaviour as is observed in sexual safflower genotypes confirming thereby the sexual nature of embryo development in them.
- 3) Inheritance of exomorphic apomixis-indicating traits in safflower crosses involving both genotypes with twin-embryo seeds and those producing single-embryo seeds has been studied. Evaluation of F<sub>1</sub>s for exomorphic characters showed normal-stemmed plants producing single seeds. This study revealed that F<sub>2</sub> populations of all the crosses

segregated into a ratio of 13:3 (normal stem: fasciated stem), suggesting a role of inhibitory gene action in expression of fasciated stem in safflower. Similarly, in the same F<sub>2</sub> population the trait twin-embryo seeds was also observed to be governed by inhibitory gene action (13 single-seed plants: 3 twin-seed plants). Thus stem fasciation and twin-embryo seeds in interspecific derivatives were controlled digenically and were found to be linked in coupling phase.

## **SWEET SORGHUM**

**Project 1:** Development of photo-thermoinsensitive sweet-stalk sorghum variety and hybrid having attributes desired by ethanol industry

**Funding agency:** Indian Council of Agricultural Research (ICAR), New Delhi.

**Project duration:** December 1, 2005 to November 30, 2008

### **Objectives:**

1. To develop photo-thermoinsensitive cultivars and hybrids of sweet sorghum suitable for grain, fodder and sugar production, so as to make it acceptable as a multipurpose agro-industrial crop in India especially for ethanol production.
2. To develop and improve the present CMS lines and pollinators suitably to exploit the potential of sweet sorghum hybrids for sugar and biomass production.
3. To generate information on factors such as irrigation requirement and harvesting and crushing periods.
4. To disseminate the agroproduction technology for sweet sorghum cultivation to the farmers.

### **Research Highlights:**

#### **(I) Kharif (Rainy Season) 2007:**

- (1) **Evaluation of F<sub>1</sub>s of diallel crosses for varietal improvement:** Forty-five, 10-parent diallel (F<sub>1</sub>) crosses were evaluated along with their parents for sugar yield and its components during Kharif 2007. Five crosses out of 45 evaluated recorded higher total sugar index (TSI) than the best parent RSSV-49. The maximum TSI of 3.69 T/ha was recorded by the hybrid NARI-SS-35-1 X NSS-218, which was followed by the crosses Keller X NARI-SS-35-1 and NSS-216 X RSSV-21-2 (both 3.16 T/ha) and NSS-218 X RSSV-15-2 (3.09 T/ha).
- (2) **Inheritance of biological and sugar yields and their components in sweet sorghum:** The analysis of variance for combining ability of biomass as well as sugar yields and related traits showed that variances due to general combining ability (gca) and specific combining ability (sca) were highly significant for both qualitative and quantitative traits except variances due to sca for stem diameter, total reducing sugars, sucrose and total sugars. This indicated the importance of both additive as well as non-additive gene actions in the expression of different characters in sweet sorghum. The variances due to gca were found to be considerably higher than those due to sca for all the traits studied. This suggested the predominant role of additive and additive X additive epistatic

components of genetic variance which are fixable. Parent RSSV-21-2 was observed to be the best general combiner for the traits studied in the trial and was followed by the parents NARI-SS-35-1, RSSV-49, NSS-218, Keller and RSSV-15-2. Based on the significant positive sca as well as gca effects for the different characteristics the cross combinations NARI-SS-35-1 X NSS-218, Keller X NARI-SS-35-1, NSS-216 X RSSV-21-2, Keller X NARI-SS-83, NSS-218 X RSSV-15-2, Keller X NSS-218 and RSSV-21-2 X RSSV-49 were found to be promising for stripped stalk yield, total sugar content, TSI and also the physiological traits like staygreen nature, good stem girth and lodging tolerance. The generation advancement of these may lead to development of promising sweet sorghum cultivars.

- (3) **Preliminary evaluation of CMS-based hybrids:** Out of the 46 CMS-based hybrids (line X testers) evaluated during Kharif 2007, 15 hybrids were found to be superior to the best check SSV-84 for sugar yield.
- (4) **Evaluation of advanced generation selections for sugar yield and its components:**
  - (a) About 203 individual F<sub>3</sub> plant progenies of five crosses viz. NSS-201-4 X NSS-216, NSS-201-4 X IS-9705, NSS-201-4 X Keller, IS-3552 X William and IS-3552 X Keller were evaluated during kharif-2007. Their screening resulted in identification of 141 single plant progenies giving higher sugar yield and its components than the respective checks in the trial.
  - (b) Out of 260 individual F<sub>3</sub> plant progenies of five crosses viz. RSSV-43-2 X IS-20510, RSSV-47 X IS-20510, NSS-209 X NARI-SS-41, NSS-209 X IS-20510 and NSS-218 X NARI-SS-41 which were evaluated for sugar yield and its components, 95 entries were found to be promising for different traits and were promoted to evaluate them in F<sub>4</sub> generation.
- (5) **Evaluation of promising CMS-based hybrids:** Total of 11 promising hybrids along with two checks Madhura and SSV-84 were evaluated in a randomized complete block design with three replications during Kharif 2007. The hybrid NSS-1023A X IS-14446 was found to be the most promising as it recorded the highest TSI of 3.46 T/ha as against the 2.88 T/ha obtained for the best check. It was followed by the hybrids NSS-1015A X IS-20510 (3.28 T/ha); 7A X RSSV-49-2 (3.03 T/ha), NSS-1015A X IS-14446 (3.02 T/ha) and 296A X RSSV-49-2 (2.95 T/ha).
- (6) **Effect of dates of sowing on sugar and other characteristics of sweet sorghum during rainy season :** The effect of dates of sowing on sweet sorghum was studied by sowing six promising sweet sorghum cultivars on four dates at fortnightly intervals starting from June 2 upto July 15. The results of the trial showed no significant differences due to sowing dates for the parameters final plant stand, plant height upto last internode and upto panicle tip, number of internodes per plant, number of green leaves per plant, juice extractability, juice yield, brix, total reducing sugars, total sugars, sucrose content, shootfly dead hearts (21 DAS), and stem borer damage at harvest. The differences due to genotype were significant for all the traits except juice yield, sucrose content and stem borer damage at harvest. The interaction effects between sowing dates and genotypes were non-significant for biomass productivity and sugar content. However, they were significant for grain yield. Among the different genotypes evaluated, the sweet sorghum genotype NARI-SSH-47 sown on June 2 recorded the maximum biomass yield of 72.22

T/ha which was followed by SSV-84 with 68.76 T/ha biomass yield on the same date. Considering the interaction effect, sweet sorghum hybrid NARI-SSH-47 and released variety SSV-84 can be sown in the first fortnight of June under protective irrigations for obtaining the maximum biomass, grain and TSI.

## (II) Rabi (Post-rainy Season) 2007-08:

- (1) **Evaluation of F<sub>1</sub> diallel crosses for varietal improvement:** Thirty nine crosses made by following diallel crossing programme were evaluated along with their parents for sugar yield and other characteristics during Rabi 2007-08. The results of the trial showed that the hybrid NSS-216 X Keller gave higher TSI than the highest sugar yielding parent Keller.
- (2) **Evaluation of CMS-based hybrids for sugar yield and other characteristics:** Forty nine CMS-based hybrids along with their parents and three checks were evaluated for sugar production in a replicated trial. The results showed that 21 hybrids recorded higher total sugar yield than the best parent NSS-208 (1.07 T/ha). The hybrid MS 70A X RSSV-43-2 recorded the highest total sugar yield of 1.87 T/ha.
- (3) **Evaluation of advanced generation selections for sugar yield and its components:** About 341 F<sub>3</sub> individual plant progenies of six crosses viz. Keller X NARI-SS-35-1, Keller X NSS-218, NARI-SS-35-1 X NSS-218, NSS-218 X RSSV-15-2, NSS-216 X RSSV-21-2 and RSSV-21-2 X RSSV-49 were evaluated during Rabi 2007-08. The superior F<sub>3</sub> single plant progenies based upon the sugar yield and its components were selected for further evaluation in F<sub>4</sub> generation to identify the most promising ones for generation advancement and eventual release as a variety.
- (4) **Preliminary evaluation of CMS-based hybrids for sugar yield and its components:** Fifty six hybrids along with their parents and three checks were evaluated for sugar production in a replicated trial. The results showed that four hybrids viz. MS 70A X NARI-SS-35-1 (2.02 T/ha), NSS-1019A X NTJ-2 (1.94 T/ha), NSS-1021A X NARI-SS-35-1 (1.81 T/ha) and NSS-1019A X NARI-SS-35-1 (1.8 T/ha) recorded higher TSI than the best check RSSV-9 (1.75 T/ha).

**Project 2:** Breeding sweet-stalk sorghum varieties and hybrids giving high biomass, sugar, cellulose and hemicellulose with low grain.

**Funding agency:** Nagarjuna Fertilizers and Chemicals Ltd. (NFCL), Hyderabad

**Project duration:** October 1, 2006 to September 30, 2011

### Objectives:

1. To optimize sugar content, biomass yield, cellulose content and hemicellulose content in sweet-stalk sorghum.
2. To develop early-maturing sweet-stalk sorghum genotypes.
3. To develop sweet-stalk sorghum hybrids resistant to drought and shootfly (*Atherigona soccata*).

## Research Highlights:

Progress of the work done in the project is presented season-wise:

### (I) Kharif (Rainy season) 2007:

- (1) Evaluation of 59 CMS-based sweet sorghum hybrids at NARI, Phaltan and 35 at NFCL, Wargal resulted in identification of sweet sorghum hybrids NARI-NFSSH-40, -24 and -49 recording an increase of 50, 29 and 29% respectively in juice yield over the best check Madhura and the hybrids NARI-NFSSH-35 and -56 exhibiting total sugar index (TSI) at par with the best check Madhura at NARI, Phaltan. At NFCL, Wargal hybrids NARI-NFSSH-34 and -20 recorded the highest increase of 64% in juice yield over the best check Madhura which was followed by the hybrids NARI-NFSSH-52 (56%), -21 (53%) and -49 (52%). However, for total soluble solids (TSS), hybrid NARI-NFSSH-60 showed the highest increase of 30% over the best check SSV-84 which was followed by the hybrids NARI-NFSSH-58 (22.22%) and -56 (22%). Considering overall performance for both juice yield and TSS, hybrids NARI-NFSSH-52, -49 and -44 were found to be the most promising as compared to the best check.
- (2) Screening of 43 pollinator parents of CMS-based crosses for sugar yield and its components resulted in identification of the parental line NARI-NFSS-235 giving the highest TSI of 2.85 T/ha. This was followed by the entries NARI-NFSS-234 (2.66 T/ha), -210 (2.51 T/ha), -253 (2.29 T/ha) and -84 (2.27 T/ha). Entries giving high grain yield were identified as NARI-NFSS-183 (39.27 q/ha), -234 (36.58 q/ha) and -37 (36.44 q/ha). Thus NARI-NFSS-234 gave high TSI as well as grain yield.
- (3) Forty three sweet and fiber sorghum genotypes which were evaluated under winter conditions were sown in rainy season to assess their performance for sugar yield and its components. The entries identified as producing high TSI are NARI-NFSS-233 (3.67 T/ha), -27 (2.92 T/ha), -108 (2.91 T/ha) and -158 (2.80 T/ha). Entries giving high stripped stalk yield, juice yield and brix % were also identified in the investigation.
- (4) Ninety two sorghum land races collected from rabi sorghum growing areas in parts of western Maharashtra and Belgaum in Karnataka during winter 2006-07 were evaluated in an unreplicated trial during rainy season of 2007 to assess their performance for sugar yield and its components and other physiological traits. The evaluation of land races showed the presence of a wide range of variability for different traits. Fourteen land races of the 92 evaluated showed higher TSI than the best check SSV-84. The entry NARI-LC-07-54 recorded the highest TSI of 2.15 T/ha and was followed by the entries NARI-LC-07-46 (1.5 T/ha) and -07-81 (1.46 T/ha).
- (5) Eighty four germplasm lines possessing desirable traits were obtained from ICRISAT, Patancheru. They were evaluated in an unreplicated trial for sugar yield and its components during the season. The germplasm evaluated exhibited a good amount of variability for different traits studied. The study showed that four genotypes exhibited plant height > 500 cm. The maximum plant height of 590 cm was given by the entry IS-19717 which was followed by the entries IS-19762 (543 cm) and IS-19815 (539 cm). The study revealed that 12 out of the 84 genotypes evaluated gave higher brix % than the best check Madhura. The entry IS-19778 recorded the highest TSI of 1.7 T/ha which was followed by the entries IS-147 (1.39 T/ha), IS-19688 (1.18 T/ha) and IS-20758 (1.0



T/ha). All the three checks recorded brix < 15%. Therefore sugar analysis of juice in them was not carried out and hence there was no estimation of TSI for them.

- (6) Twenty sorghum genotypes possessing desirable traits were collected from sorghum research centers in India. They were evaluated in an unreplicated trial for sugar yield and its components. Of the 20 entries evaluated the entry CSV-15 recorded higher TSI than the best check SSV-84.
- (7) Two hundred fifty one germplasm lines maintained at the center were screened in an unreplicated trial for different physiological traits and sugar yield under kharif conditions to identify the genotypes suited for growing under kharif conditions. The germplasm evaluated varied greatly for different traits examined. The study showed that 31 entries of the 251 studied recorded higher brix % than the best check SSV-84 (17.5%). The brix % among the test entries ranged from 6.0 to 21%. Five genotypes of the 251 were found to give higher TSI than the best check Madhura. They were: (1) NARI-NFSS-31 (3.01 T/ha) (2) NARI-NFSS-180 (2.88 T/ha) (3) NARI-NFSS-116 (2.78 T/ha) and (4) NARI-NFSS-169 (2.77 T/ha).
- (8) Eighty one pairs of CMS A&B lines obtained from ICRISAT, Patancheru were screened in an unreplicated trial during the rainy season for sugar and its components. This resulted in the identification of genotypes giving high fresh biomass yield, stripped stalk yield and brix % apart from TSI. The entries observed to be giving high TSI were (1) ICSB-1023 (1.67 T/ha), ICSB-479 (1.41 T/ha), ICOSA-1039 (1.36 T/ha), ICSB-1035 (1.25 T/ha) and ICSB-318 (1.23 T/ha). The CMS lines identified as giving high TSI and brix during kharif season have been used in the crossing programme to develop hybrids giving high TSI.

#### (9) Crossing programmes :

Three crossing programmes were undertaken during the season, the details of which are as follows:

- (i) **Development of CMS-based hybrids:** A total of 105 crosses following line X tester design by using seven CMS lines as females and 15 promising genotypes possessing desirable traits as males were attempted to develop hybrids giving high sugar and biomass yield.
- (ii) **Crossing programme for development of sweet sorghum CMS lines:** A 12-parent diallel crossing programme using five promising male sterility maintainer B lines and seven sweet sorghum genotypes was executed to develop sweet sorghum CMS lines and also to generate information on inheritance of sugar yield and its components in them so that a proper breeding strategy to develop CMS lines as well as other genotypes high in sugar could be formulated.
- (iii) **Crossing programme for improvement of R lines for shootfly tolerance and sugar yield and its components:** A 10-parent diallel crossing programme



comprising of the parents with shootfly tolerance, high biomass and high brix was undertaken during the season to develop shootfly-tolerant sweet sorghum cultivars producing high sugar and biomass.

- (10) Exploration of sorghum land races from kharif sorghum growing areas in parts of Maharashtra was undertaken to enrich the germplasm resources with resistance to various biotic and abiotic stresses apart from sweetness. About 31 collections of land races were made which varied for plant height, earhead type, grain colour, brix %, juiciness etc.

**(II) Rabi (Post-rainy season) 2007-08:**

- (1) Out of the 53 CMS-based sweet sorghum hybrids (same as those evaluated in Kharif 2007) evaluated during Rabi 2007-08, 12 hybrids recorded higher TSI than the best check RSSV-9 (1.31 T/ha). The maximum TSI of 3.87 T/ha was given by hybrid NARI-NFSSH-9 followed by -23 (3.26 T/ha), -55 (3.17 T/ha), -29 (2.83 T/ha) and -47 (2.63 T/ha).

The evaluation of parental lines showed that six out of the 35 pollinator parents evaluated recorded higher TSI than the best check Madhura (0.96 T/ha). The maximum TSI was recorded by genotype NARI-NFSS-130 (3.93 T/ha) which was followed by -170 (2.33 T/ha), -84 (2.22 T/ha), -210 (1.74 T/ha), -175 (1.59 T/ha) and -155 (1.37 T/ha). Thus NARI-NFSS-210 performed well under both kharif and rabi seasons.

- (2) Ninety three land races collected from Satara, Sangli and Kolhapur districts in Maharashtra and Belgaum in Karnataka during Rabi 2006-07 were again evaluated in Rabi 2007-08. The highest TSI of 2.51 T/ha was recorded by the land race NARI-LC-07-5 which was followed by the entries -07-52 (2.02 T/ha), -07-96 (1.99 T/ha), -07-9 (1.93 T/ha) and -07-54 (1.84 T/ha).
- (3) About 111 germplasm lines received from ICRISAT and other research stations in India were evaluated for sugar yield and other desired traits during Rabi 2007-08. The maximum TSI was recorded by the genotype IS-19688 (2.08 T/ha) which was followed by IS-41209 (1.83 T/ha), IS-39027 (1.82 T/ha), IS-40376 (1.64 T/ha) and IS-38666 (1.36 T/ha). Thus IS-19688 gave high TSI in rainy as well as post-rainy season.
- (4) Seventy eight pairs of CMS lines received from ICRISAT and 79 NARI CMS derivatives were maintained as well as evaluated for sugar yield and other desired parameters during Rabi 2007-08. The CMS line ICSA-1039 from ICRISAT recorded the highest TSI of 2.48 T/ha which was followed by the entries ICSA-1023 (1.71 T/ha), ICSA-1069 (1.70 T/ha), ICSA-306 and ICSA-653 (both 1.49 T/ha), ICSA-735 (1.28 T/ha) and ICSA-26004 (1.27 T/ha). Among the 79 NARI CMS derivatives, NARI-NFSS-134 recorded the maximum TSI of 1.30 T/ha. Thus ICSA-1039 performed well in both kharif and rabi seasons.
- (5) Out of the 258 station germplasm lines evaluated, the maximum TSI was given by the genotype NARI-NFSS-249 (4.0 T/ha) which was followed by the entries NARI-NFSS-130 (3.40 T/ha), -200 (2.76 T/ha), -106-1 (2.20 T/ha), -236 (2.13 T/ha) and -247 (1.88 T/ha).

- (6) Ninety CMS-based sweet sorghum hybrids produced in Kharif 2007 were evaluated in three different trials. The results of each trial are discussed separately.
- (i) **Sweet sorghum hybrid trial I:** Out of the 35 hybrids evaluated in trial 1, 19 hybrids recorded significantly higher TSI than the best check RSSV-9. The maximum TSI of 2.78 T/ha was given by the hybrid SKH-23, which was followed by the hybrids SKH-28 (1.79 T/ha), SKH-16 (1.69 T/ha), SKH-15 (1.62 T/ha), SKH-21 (1.56 T/ha) and SKH-31 (1.47 T/ha). The best check RSSV-9 recorded a TSI of 0.70 T/ha.
  - (ii) **Sweet sorghum hybrid trial II:** Sixteen hybrids out of the 35 evaluated recorded higher TSI than the best check SSV-84. The maximum TSI of 2.35 T/ha was recorded by the hybrid SKH-55 which was followed by the hybrids SKH-41 (2.1 T/ha), SKH-39 (1.77 T/ha) and SKH-70 (1.58 T/ha).
  - (iii) **Sweet sorghum hybrid trial III:** Out of the 23 CMS-based hybrids evaluated, eight hybrids recorded higher TSI than the best check RSSV-9 (1.22 T/ha). The hybrid SKH-88 recorded the maximum TSI of 2.79 T/ha which was followed by the hybrids SKH-73 (2.68 T/ha), SKH-93 (2.44 T/ha), SKH-103 (2.22 T/ha), SKH-101 (1.92 T/ha), SKH-83 (1.83 T/ha) and SKH-72 (1.44 T/ha).
- (7) The evaluation of 22 pollinator parents used in above CMS-based hybrids was carried out in Rabi 2007-08 and resulted in identification of entry NARI-NFSS-200 recording maximum TSI of 2.16 T/ha which was followed by the entries NARI-NFSS-158 (1.39 T/ha) and -233 (1.30 T/ha).
- (8) Forty one CMS-based diallel crosses along with three checks viz. Madhura, RSSV-9 and SSV-84 were evaluated in Rabi 2007-08 for sugar yield and its components. Sixteen hybrids out of the 41 evaluated recorded higher TSI than best check RSSV-9. The maximum TSI of 1.28 T/ha was given by the hybrid DC-57 which was followed by the hybrids DC-49 (1.25 T/ha), DC-58 (1.03 T/ha) and DC-43 (0.81 T/ha).
- (9) Out of another set of 33 diallel crosses (made in Kharif 2007) evaluated in Rabi 2007-08, eight hybrids recorded higher TSI than the best check SSV-84. The maximum TSI of 2.24 T/ha was exhibited by the hybrid DC-108, which was followed by the hybrids DC-78 (1.65 T/ha), DC-102 (1.6 T/ha) and DC-106 (1.51 T/ha). Also evaluation of 18 parents involved in the above crosses showed six genotypes giving higher TSI than the best check SSV-84. The maximum TSI of 2.11 T/ha was recorded by the parent NARI-NFSS-130 which was followed by the parents NARI-NFSS-131 (1.25 T/ha), -233 (1.22 T/ha) and SSV-74 (1.16 T/ha).

**Project staff:** N. Nimbkar, Ph.D.; D. R. Bapat, Ph.D. (Consultant); V. Singh, Ph.D., M. B. Deshpande, M.Sc.; S. R. Deshmukh, M.Sc.; S. V. Choudhari, B.Sc.; N. M. Kolekar, M.Sc.; J. H. Akade, M.Sc.; R. Sumitha, M.Sc.; A. Siddiqui, M.Sc.; S. L. Dake, M.Sc.; R. R. Giri, M.Sc.; T. V. Kotasthane, M.Sc.; S. D. Zagade; R. D. Kokare; R. K. Andhalkar; M. G. Shirke; H. H. Nale

## RENEWABLE ENERGY RESEARCH

**Project 1:** Ethanol lantern for rural areas

**Funding agency:** Department of Science and Technology (DST), New Delhi

**Project duration:** April 1, 2007 to September 30, 2008

**Objectives:**

1. To develop an extremely efficient lantern to run on 50% (w/w) and above ethanol/water mixture.
2. To fabricate 10 such lanterns and test them in actual field applications.
3. To evaluate the use of ethanol-water mixture as a viable renewable resource for rural lighting.

The lantern has been designed and is undergoing testing. It is a pressurized lantern and the following specifications have been achieved:

1.	Lantern	: Pressurized with rare earth oxide mantle
2.	Pressure	: 0.15-0.2 Kg/cm <sup>2</sup> (g)
3.	Light output	: 1250-1350 lumens
4.	Light efficacy	: 1.4-1.45 lumens/W
5.	Fuel used	: 50% (w/w) ethanol-water mixture
6.	Fuel consumption	: 240-250 g/hr (50% mixture)
7.	Power consumption	: 890-930 W
8.	Fuel tank capacity	: 1.1 litre
9.	Weight of lantern	: 2.4 kg (empty) 3.4 kg (with full tank)
10.	Dimensions of lantern	: 40 cms (H) 14.5 cms (D)
11.	Sound level	: 57 dB (at 1 m) } background noise 61.5 dB (at 30 cm) } 41.7 dB
12.	Material of construction	: Stainless steel and brass

Ten lanterns have been fabricated and will shortly undergo testing in rural houses.



**Project 2:** Ethanol engines for agricultural applications**Funding agency:** Nagarjuna Fertilizer and Chemicals Ltd., Hyderabad**Project duration:** 2 years**Objectives:**

1. To develop small (~ 1 kW) ethanol-powered engines for agricultural spray pumps and other applications.
2. To run these engines on low concentration ethanol-water mixture.

**Project 3:** Modification of NARI electric trike**Funded:** Internally

An electric trike designed at NARI for physically handicapped was further modified after feedback from handicapped persons.

A physically handicapped person in Pune was given the trike for his use. He is paralyzed on the right side and hence the trike was specifically designed for him. The trike performed very well on the Pune roads but then he shifted to rural areas, which necessitated major modifications in the design especially regarding traction on dirt roads. With these design modifications the trike performs very well and is being used by the person daily.



The specifications of the trike are:

1.	Drive	: A 0.375 kW motor driven by two 12 V, 32 A-hr batteries. Soft start is via Curtis electric controller
2.	Speed	: a) 2-speed gearing system with both forward and reverse drive. Heavy duty tires on rear wheels b) Maximum speed 20 km/hr
3.	Turning radius	: 1.5 m
4.	Distance traveled	: 35-40 km/charge (75-80% battery discharge)
5.	Weight	: 97 kg
6.	Dimensions	: 1.75 m (L) X 1 m (W) X 1.5 m (H)
7.	Ground clearance	: 22.5 cm
8.	Present cost	: Rs. 60,000/-

**Project 4:** Test marketing of improved pedal rickshaws to Canada

**Funded:** Internally

Eight improved pedal rickshaws designed and fabricated at NARI have been supplied to two different agencies in Canada for testing, evaluation and eventually marketing. If successful then there is a possibility of large orders and subsequent commercialization in Canada.

**Project 5:** Development of a mini plot thresher running on renewable energy for safflower

**Funded:** Internally

**Objectives:**

1. To mechanize threshing of safflower research plots.

To mechanize threshing of safflower trial plots, a battery-operated mini plot thresher was designed and developed at NARI. The mini plot thresher was subjected to 32 field tests during 2006-07 and the results are furnished below:

- (i) A mini plot thresher running on a battery-powered motor worked successfully for seven hours per day when used intermittently.
- (ii) It can thresh 2 Kg of safflower seed per hour.
- (iii) The machine was operated for 32 man-days and comparison was made with hand-threshing operation carried out by different labourers simultaneously. The tests showed that the threshing efficiency of the machine is 2.5 times that of the hand-threshing operation and cleaning efficiency of the machine is as good as hand-cleaning in getting seed free from inert matter.
- (iv) Based on comments of persons operating the machine for threshing safflower research plots, it was concluded that machine-threshing gave more work satisfaction than hand-threshing for many reasons like shorter work periods due to ease of dealing with spiny material, less fatigue, getting twice the amount of cleaned produce as compared to hand-threshing and cost of machine-threshing which was comparable to that for hand-threshing.



During Rabi 2007-08 the machine was again operated for threshing the safflower research plots for 24-man days. It worked smoothly without any difficulty during this period.

**Project staff:** Anil K. Rajvanshi, Ph.D.; S. J. Tambe, M.Tech. Jonathan Raphael (Intern); S. M. Patil; D. B. Gadhave; A. M. Pawar; R. S. Bale

## ANIMAL HUSBANDRY RESEARCH

### Research and extension activities

1. **Ongoing project:** “Improved productivity, profitability and sustainability of sheep production in Maharashtra through genetically enhanced prolificacy, growth and parasite resistance”

**Funding Agency:** Australian Centre for International Agricultural Research (ACIAR)

The funding for the project ended on 31 December 2007. We applied for an unfunded extension of the project for one year which was sanctioned. We have organized an international workshop [“The Helen Newton Turner Workshop on Using the \*FecB\* Gene in Sheep Breeding Programs”](#) from 10-12 November 2008 in collaboration with the National Chemical Laboratory (NCL) and the University of New England (UNE), Australia. It was necessary to get the unfunded extension for the project to get funding for the workshop from ACIAR.

Sixteen eminent scientists from India and seven other countries have been invited to speak at the workshop and the papers they present will be peer-reviewed and available in full length in published workshop proceedings in the ACIAR proceedings series. Between these and the workshop sessions we plan to thoroughly review our current understanding of the *FecB* gene and re-evaluate the possibilities it offers for genetic improvement of reproductive rate in sheep from a very practical perspective.

### Prestigious award declared to NARI for work done by the Animal Husbandry Division

The Director General, Council of Scientific and Industrial Research on the occasion of CSIR Foundation day, announced the CSIR Award for S&T Innovations for Rural Development - 2007 jointly to the Nimbkar Agricultural Research Institute (NARI), Phaltan along with National Chemical Laboratory (NCL), Pune for “Use of the *FecB* (Booroola) gene in Deccani breed of sheep, to increase lamb production and thereby the incomes of shepherds” and to the National Research Centre on Yak (NRC-Yak), Dirang for “Improvement of Sustainable Yak Husbandry Practices in Himalayan Region”. The award carries a cash prize of Rs.10 lakh, a citation and a shield. CSIR has instituted the ‘CSIR Award for S&T Innovations for Rural Development (CAIRD)’ to recognize and honour S&T innovations that have helped transform the lives of rural people.

Announcing the award CSIR Chief, Dr. T Ramasami said, “Like most other breeds of sheep in India, *Deccani* sheep have a comparatively low reproductive rate, producing one lamb every 10 to 12 months. More than 80% of the income of shepherds rearing *Deccani* sheep comes from sale of lambs. NARI in collaboration with NCL has successfully introduced *FecB* gene in Deccani sheep to enhance lamb production. A new strain of *Deccani* sheep with higher productivity called ‘NARI Suwarna’ has thus been developed. The *FecB* gene carrier ewes produce twin lambs at every alternate lambing, giving an average litter size of 1.5 compared to 1.0 in the *Deccani*. This increase is high enough to bring about a substantial increase in the shepherd's income and would thus transform gradually the rural economy.”



## Progress summary of the project

### Objective A: Ongoing production of appropriate genotypes for testing in shepherds' flocks

During 2007, two artificial insemination (AI) programs were carried out in the NARI sheep flock; 536 ewes were inseminated, 352 ewes lambed, 461 lambs were born and 423 were weaned. Large numbers of breeding rams were used for AI (27 and 43 in the two programs) to control inbreeding. The primary selection of rams and ewes was done using a selection index of Estimated Breeding Values (EBVs) for reproduction and growth traits. Conformation and facial features preferred by local shepherds were also considered as selection criteria. Allotment of rams to ewes (mate selection) was done using the TGRM program to maximize genetic merit while minimizing relationships in the flock. During the year, 342 DNA samples from NARI and 313 from shepherds' flocks were genotyped by NARI and NCL staff members jointly. We have succeeded in reducing the proportion of non-amplified or doubtful samples that had to be repeat-tested to 12% and 28% (from 50% in 2006) among NARI and shepherds' animals respectively.



Lambing records at NARI from 2002 to 2007 were analyzed as these were the years with availability of substantial records of heterozygous and homozygous *FecB* carrier ewes. Records were available on 808 non-carrier, 532 heterozygous and 47 homozygous ewes and the results of the analysis of litter size and fertility are presented below.

Trait	Least squares means		
	Non-carrier (++)	Heterozygous (B+)	Homozygous (BB)
Conception rate to artificial insemination (%)	74	80	76
Litter size at birth per ewe lambed	1.02	1.57	1.63
Litter size at 3 months per ewe lambed	0.96	1.33	1.30

These data indicate that as far as litter size is concerned the homozygous ewes are very similar to heterozygotes. While this needs to be confirmed as the number of records increases this is an important development which suggests that the risk of adverse reproductive outcomes in homozygous ewes due to excessive litter size is low. At the end of 2007 there are 500 ewes available for breeding. Out of these, 80 are *FecB* homozygous, 260 are heterozygous and 160 are non-carrier ewes. A nucleus Garole flock of 46 adult ewes, 27 young ewes and seven adult rams is being maintained at NARI.

### Objective B: Ongoing dissemination of improved *FecB* carrier rams and semen into shepherds' flocks and evaluation of performance data

Eighteen homozygous *FecB* carrier rams were introduced into 13 shepherds' flocks for breeding. These flocks with about 900 ewes in total are intensively monitored i.e., all animals have ear tags, are weighed every two months and lambs are genotyped. Additionally, 18 homozygous and eight heterozygous *FecB* carrier rams were introduced into 19 'less intensively monitored' flocks with about 1000 breeding ewes in total. Animals in these flocks are neither ear-tagged nor weighed and only female lambs are genotyped from those flocks



where the breeding rams are heterozygous for *FecB*. NARI's rams have sired total 287 lambs in these flocks during the year and NARI's ewes in these flocks gave birth to 52 lambs during the year. The number of lambs is low because some rams had to be withdrawn due to a bluetongue outbreak and by the time they could be reintroduced, the ewes in those flocks were pregnant. There is also always a conflict when a significant number of rams has to be kept behind for NARI's own breeding program. The proportion of *FecB* carrier adult breeding ewes in intensively monitored participating flocks has increased from 20% to 28% over the reporting period (245 out of 876).

Data files are being prepared for final analysis of biological and economic benefits from introduction of the *FecB* gene. We hope to finish this analysis by the end of June 2008.

Results of a preliminary analysis of records of four *FecB* homozygous, 196 heterozygous and 1360 non-carrier ewes in participating shepherds' flocks are given below.

Trait	Least squares means (Numbers in brackets are number of records.)		
	Non-carrier (++)	Heterozygous (B+)	Homozygous (BB)
Litter size at birth per ewe lambled	1.02	1.44	1.69
Litter size at 3 months per ewe lambled	0.88 (3636)	1.08 (431)	1.22 (9)

**Objective C:** Socio-economic analysis of the *FecB* dissemination program implemented in local smallholder flocks from 2003-07

Interviews of 18 shepherds participating in the project, whose flocks are intensively monitored, were held from November 2006 to February 2007. Eight shepherds, with whom we had to stop working due to various reasons, were interviewed in August 2007. The draft survey questionnaire prepared in 2006 was used for this. This questionnaire was re-examined in 2007 in the light of the filled questionnaires to see whether it achieved the objectives of the survey. We modified it based on the experience gained and it was used to conduct a second round of interviews of 15 of the same shepherds in April 2008, as decided in the last coordination meeting. A marked change in management brought in by all the shepherds is that they have started keeping the lambs back when the ewes go grazing and giving them nutritious leguminous fodder grown by them. They have all seen a beneficial effect of this practice on lamb weights and price gained.

**Gifts of books to the AHD Library:**

Books were donated to the library during the year by

1. Mr. Ralph van Gelder, Australia
2. Dr. Bob Clements, Australia
3. Prof. Michael Hare, Thailand
4. Dr. Harindar Makkar, International Atomic Energy Agency, Austria
5. Dr. Ramesh Rao, National Research Centre on Onion and Garlic, Rajgurunagar, Pune. Dr. Rao is a well-wisher of NARI. He donated about 50 books on forage and grasses for livestock from his personal collection including some valuable conference proceedings. Due to his efforts the International Center for Tropical Agriculture

(CIAT), Colombia in South America made available the seed of 'Mulato' - a high yielding, high quality forage grass to the Institute.

**Project staff:** C. Nimbkar, Ph.D.; P. M. Ghalsasi, B.V.Sc.; P. P. Ghalsasi, B.Sc.; K. M. Chavan, S. R. Kulkarni, A. H. Magar, R. T. Khanvilkar, D.D. Mulik, D. J. Bhandari and 15 shepherds and farm workers.

## **I. PUBLICATIONS**

### **Refereed publications:**

1. Nimbkar C., Gibson J., Okeyo M., Boettcher P. and Soelkner, J. 2008. Sustainable use and genetic improvement. **Animal Genetic Resources Information**. Special issue: Scientific forum of Interlaken Conference. 42: 49-65.
2. Nimbkar C., Ghalsasi P. M., Nimbkar B. V., Walkden-Brown S. W., Maddox J. F., Gupta V. S., Pardeshi V. C., Ghalsasi P. P. and van der Werf J. H. J. 2007. Reproductive performance of Indian crossbred Deccani ewes carrying the FecB Mutation. Proceedings of the **Seventeenth Conference of the Association for the Advancement of Animal Breeding and Genetics**, Armidale, Australia, 23-26 September 2007. 17: 430-433.
3. Rajvanshi, Anil K. 2007. [Energy for rural poor – challenge for global community](#). **Current Science** 10 September. 93 (5): 621-627.
4. Rajvanshi Anil K. 2007. Sustainable energy for rural development. In: **Proceedings of International Conference on China Rural Energy Development**, Beijing. Nov. 23. Published by ONELG, China and UNDP, New York.

### **Book:**

1. Rajvanshi Anil K. 2007. [1970's America – An Indian Student's Journey](#). Nimbkar Agricultural Research Institute, Phaltan. pp. 166.

### **Non-refereed publications:**

1. Anon. Mulato. Leaflet about the high yielding high quality grass Mulato. August 2007. Nimbkar Agricultural Research Institute. 4 pp.
2. Anon. First aid treatment in goats and sheep. (Shelya-mendhyanmadheel prathamopchar). Marathi booklet. October 2007. Nimbkar Agricultural Research Institute. 9 p.
3. Gadre Amit. 2007. A series of Marathi articles on the new strain of FecB carrier Deccani sheep with higher prolificacy called 'NARI Suwarna' developed under the ACIAR-funded project, "Agrowon" daily of Sakal Papers. 26-29 November.
4. Nimbkar C. 2008. 'Boer' goat rearing ('boer' sheli palan) – Marathi article published in magazine "Baliraja" March. p. 41-45.

5. Nimbkar C., Ghalsasi P. M., Walkden–Brown S. W. 2007. Harnessing genetics to increase sheep production on the Deccan plateau. South Asia Newsletter of Australian Centre for International Agricultural Research (ACIAR). July. P. 1-3.
6. Nimbkar, N. Annual Progress Report of Ad-hoc Project on “Development of photo-thermoinsensitive sweet-stalk sorghum variety and hybrid having attributes desired by ethanol industry”, submitted to ICAR, New Delhi. March 2008 (Pgs 108).
7. Rajvanshi Anil K. 2007. [Farming for energy](#). Lead editorial article. Times of India. June 6.
8. Rajvanshi Anil K. 2007. Free will, evolution and theory of chaos. Editorial page article. Times of India. August 30.
9. Rajvanshi Anil K. 2008. India, China and Rural Technology. Editorial Article in Project Monitor (Weekly). January 6. Also published in [boloji.com](#).
10. Singh, Vrijendra. Annual Progress Report of Ad-hoc Project on “To study origin of seeds with twin embryos and of fused multiple seeds, their inheritance and relationship with possible existence of polyembryony and/or apomixis in safflower”. Submitted to ICAR, New Delhi. May 2007 (Pgs. 15).
11. Singh, Vrijendra. Annual Progress Report of All India Coordinated Research Project on Oilseeds (Safflower). 2007. Submitted to DOR, Hyderabad. June 2007 (Pgs. 129).
12. Singh, Vrijendra. Annual Progress Report of Frontline Demonstrations in Safflower. Submitted to DOR, Hyderabad. June 2007 (Pgs. 122).
13. Singh, Vrijendra. Half-yearly Progress Report (January to June) of All India Coordinated Research Project on Oilseeds. Submitted to DOR, Hyderabad. August 2007. (Pgs. 10).
14. Singh, Vrijendra. Quarterly Progress Report of Ad-hoc Project on “Breeding sweet-stalk sorghum varieties and hybrids giving high biomass sugar, cellulose and hemicellulose along with early maturity and drought and insect resistance”. Submitted to NFCL, Hyderabad. August 2007 (Pgs. 30).
15. Singh, Vrijendra. Annual Progress Report of Ad-hoc Project on “Breeding sweet-stalk sorghum varieties and hybrids giving high biomass, sugar, cellulose and hemicellulose along with early maturity and drought and insect resistance”. Submitted to NFCL, Hyderabad. February 2008 (Pgs. 109).
16. Singh Vrijendra, Deshpande M. B., Deshmukh S. R. and Nimbkar N. 2007. Non-spiny safflower – a sustainable crop (Binkateri kardai-Ek shashwat peek). Marathi article published in magazine “Annadata”. September. p. 29-31.

## **II. TRAINING AND EXTENSION ACTIVITIES**

1. NARI held a training workshop on 31 October 2007 on "First aid treatment in sheep" for shepherd couples (62 men and women) participating in the project. An illustrated Marathi booklet 'First aid treatment in goats and sheep', prepared by NARI was released at the time. Each participant was given a copy of the booklet and a first aid kit with medicines and other supplies. Some funding for the workshop was obtained from the Maharashtra government's 'Agricultural Technology Management Agency'.
2. The following one-day training programs were also conducted for smallholder shepherds. In the two programs conducted on NARI's Lundy farm, shepherds were shown the management of young lambs at NARI. In all the other programs, the concepts that sheep can have twin lambs due to the FecB gene and how this can increase profits were explained to the participating shepherds. They were shown the CD prepared by NARI about the management of twin lambs and their questions were answered. About ten of the participants later visited NARI's Wadjal farm to see the NARI Suwarna breeding rams.

Date (2007)	Place	Participants	
9 June	Modnimb, Dist. Solapur	76	
10 July	NARI's Lundy farm, Rajale	21	
13 July	Bhavenagar, Tal. Koregaon	300	Organized by Maharashtra Sheep and Goat Corporation
23 July	NARI's Lundy farm, Rajale	19	
30 July	Salape, Tal. Phaltan	60	Organized by Maharashtra Sheep and Goat Corporation
10 Sept	Salape, Tal. Phaltan	49	
27 Sept	Ahmednagar, Dist. Ahmednagar	20	Organized by Bosco Gramin Vikas Kendra
2 Oct	Ahire, Tal. Khandala	19	
26 Dec	Warwand, Tal. Daund, Dist. Pune	18	
	Total	582	

3. Mr. Ajit N. Sahasrabudhe a B.Sc. Part II (Microbiology) student of H. V. Desai College, Pune was given one month training in microtomy, cytological preparations, oil estimation, sugar estimation and testing of potability of water in May 2007.
4. Ms. Laura Henckel and Ms. Caroline Dalby completed a 3-month (June-September 2007) training period in biogas technology as third year placement students from Ecole d' Ingenieur Agro-Development International, Cergy-Pontoise cedex, France.
5. Dr. M. Amle and Dr. V. Birade, Head of the Department of Veterinary Gynaecology and Obstetrics from Krantisinh Nana Patil Veterinary College, Shirwal, Tal. Khandala, Maharashtra were given practical and theoretical training in artificial insemination in goats on 7 June 2007.
6. A speech on 'Boer Goat' by Dr. Chanda Nimbkar was broadcast on Pune radio in June 2007.

7. An interview of Mr. Eknath Pisal, a participating shepherd in the ACIAR project, was broadcast on television (govt. channel Doordarshan) on 15 October 2007.
8. Mr. Ibrahim Patel and Mr. Azim Patel were given training in sheep management including care of newly lambed ewes and their lambs, on 14 Nov-31 Dec 2007 on NARI's Lundy farm. They were sent for training by Mr. Eashak Kader Patel who intends to establish a large sheep farm in Khandala taluka and keep *FecB* carrier ewes.
9. A one-day training and consultancy program was conducted at NARI for the members of BAIF Development Research Foundation, Karnataka on 19 November 2007.
10. Mr. Jonathan Raphael, a student from Olin College of Engineering, Massachusetts, U.S.A. did his internship at NARI for 2 months (October-November 2007).
11. Shri Dipak R. Bobade stayed at Animal Husbandry Division's farm from 22 December to 30 January 2008 to obtain hands on training in goat management and artificial insemination.
12. Ms. Ashwini Chopade, a second year veterinary student of Krantisinh Nana Patil Veterinary College, Shirwal, Tal. Khandala worked to obtain practical training in goat and sheep management from 8 to 19 January 2008.
13. Dr. D. Balakrishna Rao of Sreepati Agencies and Veterinary Consultants working in sheep in Andhra Pradesh came to know about the new strain of Deccani sheep 'NARI Suwarna' developed by NARI. He visited in October 2007. He is interested in dissemination of the *FecB* gene in Nellore sheep flock of Andhra Pradesh. Dr. Rao and his assistant Dr. Supekar were given one day training of blood collection on FTA paper for DNA testing on 19 January 2008.
14. Three persons sponsored by NGOs Gram in Nizamabad (AP) and Samuha in Raichur (Karnataka) were trained in the technology of syrup preparation from sweet sorghum juice on 30 January 2008.

### **Dissemination of seed and other products**

During the year 287 kg seed of various safflower varieties, hybrids and their parents and 459 kg seed of Madhura sweet sorghum hybrid were distributed to various farmers and companies. Also 45 kg dried safflower flowers were sold as herbal health tea. About 692 kg sweet sorghum syrup was sold during the year.

### **Dissemination of animals**

The following *FecB* carrier breeding rams were disseminated in addition to those introduced into local smallholder flocks for breeding.

During 2007, 10 *FecB* homozygous (BB) and 3 heterozygous (B+) rams were disseminated by NARI to various Government and non-government organizations and private individuals. Notably,

- Two BB and one B+ ram disseminated to the Sheep Husbandry Dept. of Jammu and Kashmir State.
- The Animal Breeding and Genetics Dept. of the Sher-e-Kashmir University in Srinagar purchased five BB rams for the "Project on the Fecundity Gene" financed by the Dept. of Biotechnology.
- An NGO, Small Scale Sustainable Infrastructure Development Fund in Mahbubnagar, Andhra Pradesh State purchased two BB rams. Smallholder shepherds working with them came to Phaltan to choose the rams.

### **III. TRAINING RECEIVED BY NARI STAFF**

1. Mr. N. M. Kolekar and Mr. Anaytullah Siddiqui were trained on 20 and 21 August 2007 by Dr. U. D. Chavan (Food Technology Laboratory) and Dr. Y. G. Fulpagare (HOD, Dept. of Dairy Science and Animal Husbandry) in techniques for sugar estimation in sweet sorghum juice at the Mahatma Phule Agricultural University, Rahuri.
2. Dr. Anil K. Rajvanshi attended a course entitled "Intellectual Property Rights and World Trade Organization Related Issues" Sponsored by DST at the Administrative Staff College of India (ASCI) at Hyderabad from 24-28 September 2007.
3. Shri K. M. Chavan attended the winter school on 'Small Ruminant Feeding Systems for Commercial Mutton Production and Value Addition to Augment Income Generation' at Avikanagar organized by the Central Sheep and Wool Research Institute from 20 November to 10 December 2007.

### **IV. CONFERENCES / SEMINARS / MEETINGS / WORKSHOPS ATTENDED BY STAFF AND LECTURES GIVEN (In chronological order)**

1. Dr. Chanda Nimbkar attended the Research Review Committee Meeting 2006-07 of Animal Science, Dairy Science and Veterinary Science at the Mahatma Phule Agricultural University, Rahuri, Maharashtra on 11 April 2007.
2. Dr. Chanda Nimbkar gave a presentation on "Pastoralists oriented work" carried out at NARI and chaired a session on 'Breeds and breed improvement' at a meeting on "Pastoralism and rangeland conservation" organized by the Ford Foundation at Ahmedabad. 9-10 July 2007.
3. Dr. P. M. Ghalsasi, Ms. Padmaja Ghalsasi, Mr. K. M. Chavan and Mr. Shyam Kulkarni attended a workshop on 'Vaccination and deworming of sheep' held by Animal Husbandry Dept of Satara Zilla Parishad, Maharashtra and Punyashlok Ahilyadevi Maharashtra Sheep and Goat Development Corporation Ltd. held at Bhavenagar, Tal. Koregaon, Dist. Satara on 13 July 2007. Dr. Ghalsasi gave a presentation on "NARI's activities in shepherds' flocks, 'NARI Suwarna' sheep and PPR and bluetongue diseases in sheep".

4. Dr. Anil K. Rajvanshi was invited to address the key engineers and technologists at National Thermal Power Corporation (NTPC) Head Office in August 2007 in New Delhi. He gave a talk entitled “Distributed Rural Electrification”. During this Delhi visit he also had a detailed discussion with Shri. K. C. Pant (former Vice Chairman Planning Commission) and Dr. Kirit Parikh (present member of Planning Commission) on various issues of rural development and energy.
5. Dr. V. Singh, Mr. M. B. Deshpande and Ms. R. Sumitha attended the Annual Rabi Oilseeds Research Workers’ Group Meeting held at Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan) from August 23-25, 2007.
6. Dr. Chanda Nimbkar presented the paper ‘Sustainable use and genetic improvement’ in the Scientific Forum at the First International Technical Conference on Animal Genetic Resources for Food and Agriculture organized by the Food and Agriculture Organization of the United Nations at Interlaken, Switzerland on 3-7 September 2007.
7. Dr. Chanda Nimbkar attended the seventeenth Conference of the Association for the Advancement of Animal Breeding and Genetics held in Armidale, Australia on 23-26 September 2007. She presented a paper ‘Reproductive performance of Indian crossbred Deccani ewes carrying the *FecB* mutation’.
8. Dr. Chanda Nimbkar was invited to visit the CSIRO Division of Animal Production at Chiswick, NSW, Australia on 4 October 2007. She gave a one hour presentation on the activities of the Nimbkar Agricultural Research Institute with special reference to the Animal Husbandry Division and held discussions with staff scientists.
9. Mr. K. M. Chavan delivered a lecture at the training program on ‘Goat Management’ at Bosco Gramin Vikas Kendra, Ahmednagar on the activities of the Institute, artificial insemination in sheep and goats and twinning in sheep to the students of the goat management training program on 4 October 2007.
10. Dr. Anil K. Rajvanshi gave an invited talk at Nehru Center in Mumbai in October 2007. His talk, organized by Nehru Center was entitled “Sustainable rural development – A Gandhian perspective”.
11. Dr. Anil K. Rajvanshi gave an invited talk entitled “Nanotechnology for rural development”, at The Energy Research Institute (TERI), New Delhi during a half-day workshop on Nanotechnology in India’s development, sponsored by IDRC, Canada. During this Delhi visit in October 2007 he also met Shri. Jairam Ramesh, the Union State Minister of Commerce and Power and had lengthy discussion with him on the role of NARI regarding sweet sorghum R&D for India.
12. Dr. Anil K. Rajvanshi was invited as an expert to attend the stakeholders’ workshop for development of the full proposal on the concept note on “Biomass-based decentralized power generation for agro-enterprises” (for NAIP funding under component-2) at the Central Institute of Agricultural Engineering (CIAE), Bhopal. The one-day meeting took place on 9 October 2007.

13. Dr. V. Singh attended Consultation meeting on Hybrid Parents Research on 31 October 2007 at ICRISAT, Patancheru (A.P.) to discuss the future hybrid parents' research at ICRISAT.
14. Dr. Chanda Nimbkar participated in the panel discussion on "Making animal breeding work for the poor amidst the excitement of the genetic revolution" at the John Vercoe Memorial Conference "Animal breeding for poverty alleviation – harnessing new science for greater impact" held at Nairobi, Kenya by the International Livestock Research Institute on 8-9 November 2007.
15. Dr. Anil K. Rajvanshi gave an invited talk in November 2007 to MBA students of Kalinga Institute of Rural Management in Bhubaneswar, Orissa. His talk was entitled "How MBAs can help in rural development".
16. Dr. Anil K. Rajvanshi went to China in November 2007 as an UN expert to advise the Office of National Energy Leading Group (ONELG) which is directly under the chairmanship of the Prime Minister Mr. Wen Jiabao. Dr. Rajvanshi also gave a keynote address at the International Conference on China Rural Energy Development held in Beijing on November 23, 2007. His talk was entitled "Sustainable Energy for Rural Development". During this trip he was also interviewed by China News Agency and the interview appeared on their [website](#).
17. Dr. Rajvanshi attended the advisory committee meeting of Maharashtra Energy Regulatory Commission in Mumbai in November 2007.
18. Dr. Anil K. Rajvanshi was the chief guest at the Energy Day function organized by Maharashtra Scooters Ltd., Satara in December 2007. He gave a talk entitled "Energy Awareness" to about 400 staff including engineers and technicians.
19. Dr. P. M. Ghalsasi gave two presentations on the 'Use of the FecB gene to increase sheep productivity' at National Animal Genetics Resources Centre and Data Bank of Uganda and at Makerere University during his visit to Uganda. This visit was sponsored by Dr. Lorna Brown, Wales, UK so that Dr. Ghalsasi could help her with oestrus synchronization and artificial insemination work under 'The Village Goat Improvement Program' from 9-14 December 2007.
20. Dr. V. Singh attended Proactive Workshop at NASC, New Delhi on 28 December, 2007 as CPI of successful concept note to get guidelines on writing of the full proposal of NAIP project on safflower.
21. Dr. Anil K. Rajvanshi gave an invited talk to the R&D group and Senior Management Staff of Honeywell Corporation in Bengaluru in December 2007. His talk was entitled "How corporate world can help in developing sustainable rural energy". The talk has led to a joint program of rural energy development between NARI and Honeywell.
22. Dr. Anil K. Rajvanshi was invited as a keynote speaker in December 2007 at Pune Expo 2008. The yearly expo is organized by Mahratta Chamber of Commerce, Industries and Agriculture (MCCIA). Dr. Rajvanshi gave a talk entitled "Renewable Energy Development for Sustainable Environment".



23. Dr. V. Singh and Mr. J. H. Akade attended meeting of TAG-2 experts of NAIP on 22 January 2008 at NASC, New Delhi to present the proposal on ‘Commercialization of safflower flowers to raise socioeconomic status of farmers in rainfed areas of Maharashtra’. Unfortunately this proposal was not funded in the second call and has been resubmitted for the third call.
24. Dr. Anil K. Rajvanshi was the chief guest at SRIJAN-a student sponsored technical fest of Indian Institute of Mines, Dhanbad (Jharkhand) held in February 2008. He gave an inspirational talk entitled “Nation Building, Engineers and Happiness”. Around 450 students, faculty and the Director of the Institute attended the talk.
25. Dr. Anil K. Rajvanshi was the chief guest at the National Seminar on Agribusiness and Entrepreneurship organized by the Economics Department of Shivaji University, Kolhapur in March 2008. He gave the inaugural address entitled “Farming for Energy and Wealth” to an audience which included economists, bankers, Shivaji University students and faculty including Vice Chancellor Dr. Manikrao Salunkhe.
26. Dr. Anil K. Rajvanshi gave a keynote speech entitled “Nano and Biotechnology for rural development”, at a two day workshop on Science and Society organized by TERI, New Delhi at their Gurgaon retreat in March 2008.
27. Dr. Anil K. Rajvanshi was the chief guest at PRAVAH 08-a student science fest organized by students of National Institute of Technology (NIT), Jamshedpur (Jharkhand) in March 2008. He gave a talk “Strategy for Sustainable Development of Rural Areas”. The talk was attended by students, staff and faculty of NIT and many prominent Jamshedpur residents including senior managers of Tata Motors.
28. Dr. V. Singh and Mr. N. M. Kolekar attended the 37<sup>th</sup> Annual Sorghum Meeting held at Punjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola on 14-15 March, 2008.
29. Dr. Chanda Nimbkar was invited by the Ministry for Panchayati Raj to attend a two day “National Consultation with Panchayats on Operationalisation of the National Policy for Farmers, 2007” on 16-17 March 2008. She was the keynote speaker for the Technical Session II on “Livestock and Fisheries” and introduced the topic of ‘Recommendations of the National Policy for farmers 2007 with respect to livestock’.

## **V. IMPORTANT VISITORS**

Large number of visitors which included farmers, students and researchers came to the Institute seeking information on agriculture, renewable energy, animal husbandry and sustainable development. Some of the important visitors who visited the institute were as follows:

1. Mr. Subodh Kulkarni and Mr. V. V. Bhuskute of Dnyan Prabodhini, Pune visited on 11 May 2007 to get information about projects at NARI.
2. Mr. A. V. Kulkarni, GM Telecom, BSNL, Satara visited NARI on 6 June 2007 for discussions regarding internet facilities.

3. Mr. Abhijit Ghorpade, Reporter, Loksatta visited the Animal Husbandry Division on 14 June 2007.
4. Dr. B. P. Pandey (Head of New Business), Dr. B. S. Rana and other scientists from Nagarjuna Fertilizers and Chemicals Ltd.(NFCL) visited NARI on 20 June 2007 regarding ongoing sweet sorghum program between NFCL and NARI.
5. Dr. B. Sethuraman, General Manager, NABARD, Mumbai, visited the Animal Husbandry Division to discuss about 'ley farming' with Shri B.V. Nimbkar and Dr. Chanda Nimbkar.
6. Dr. O. N. Maccuo, Consultant, Sheep Husbandry Department, Srinagar, Jammu & Kashmir visited the Animal Husbandry Division from 20 to 26 June 2007 to get information on the activities of the AHD in goat and sheep improvement and discuss the possibilities to introduce Boer and NARI Suwarna germ plasm in their region.
7. 30 volunteer workers of an NGO 'Paryay', from village Hasegaon in Osmanabad district visited the Animal Husbandry Division on 28 June 2007.
8. Students from agricultural college, Baramati and Shrimant Shivajiraje College of Horticulture, Phaltan visited in July and August 2007 to collect the weather records kept at NARI.
9. Smt. Pallavi Kapadnis and Smt. Jagruti Devare from Nashik visited the AHD to give a presentation about their goat unit to the members of the Maharashtra Goat and Sheep Research and Development Institute at their Annual General Meeting held at AHD, NARI on 17 August 2007.
10. Mr. Yogesh Apte of Four Seasons Biotech, Mumbai visited on August 19, 2007 regarding the testing of his plant growth regulators on different crops at NARI.
11. Shri. S. R. Patel of Krishnamai Krishi Vidnyan Mandal Audunbar, Ankalkhop visited with 10 farmers on 20 August 2007 to see the institute.
12. Mr. Rahul Marathe, Lecturer in Zoology at Sinhgad College of Science, Pune and one of his students visited the Animal Husbandry Division on 24 August 2007 and used the library to get information required for his study.
13. Dr. Neelam Gupta from the National Bureau of Animal Genetic Resources (NBAGR), Karnal, Haryana visited the Animal Husbandry Division on 26-28 August 2007 to discuss a collaborative research project proposal between NBAGR and NARI.
14. Mr. C. P. Riedel, Senior Research Economist-Biofuels from LMC International Ltd. Oxford, UK came to learn about NARI's sweet sorghum program on 3 September 2007.
15. Dr. Debmalya Banerjee, Professor, Production Engineering, Jadavpur University and Mr. Biswajit Mondal, Lecturer, Mechanical Engineering Department, Jnana Chandra Ghosh Polytechnic, Kolkata came to NARI on 13-14 September 2007 regarding the technology transfer of rickshaws to West Bengal.

16. Dr. Frantz Flambert, a former Minister of Agriculture and Rural Development, Government of Haiti and presently staying in Dominican Republic visited the Institute on 20 September 2007 regarding sweet sorghum.
17. Shri. J. V. Kale, DDM NABARD and Shri. Satishbhai Patel-an entrepreneur visited on 29 September 2007 to discuss the feasibility of setting up an ethanol plant based on sweet sorghum in Panchmahal district of Gujarat.
18. A team from CNBC TV 18 came to shoot a film on ethanol stoves, lanterns and other projects.
19. Dr. S. Audilakshmi (Principal Scientist, Plant Breeding), Dr. T. G. Nageshwara Rao (Principal Scientist, Plant Pathology) and Dr. S. S. Rao (Senior Scientist, Plant Pathology) visited NARI for monitoring of AICSIP trial in sweet sorghum on 8 October 2007.
20. Dr. Shrikant Karanjekar from Dharamitra, Vardha visited NARI on 10 October 2007 to see the activities taking place.
21. Krishi Vigyan Kendra, Baramati organized a visit of 62 farmers under their 'shivar pheri' program to NARI on 19 October 2007. The farmers were shown the field trials of safflower and sweet sorghum. Later on they visited the Animal Husbandry Division and were provided information about the sheep and goat improvement programs and new high yielding grasses.
22. Mr. Ashish Sharma, Commissioner, Animal Husbandry, Maharashtra State visited the institute on 20 October 2007 and discussed the various activities taking place. Later on he visited the animal husbandry division and was provided information about their research activities.
23. Dr. Avinash Patkar, Senior Advisor to Tata Power visited NARI on 4 November 2007 to discuss the gasification program and possible tie up of NARI with Tata Power regarding the commercialization of this technology.
24. Dr. B. S. Rana and Mr. Swaroop from NFCL visited NARI on 5 November 2007 to carry out discussions about ongoing sweet sorghum project between NFCL and NARI.
25. Dr. Chandar Puri and Dr. P. Parab of Yasharaj Biotechnology, Mumbai visited the Animal Husbandry Division to discuss about a collaborative biotechnology project on 24 November 2007.
26. A monitoring team comprising of Dr. U. V. Kale, Breeder, AICRPO, Marathwada Agricultural University, Parbhani, Mrs. P. Padmavathi, Sr. Scientist (Agronomy), DOR, Hyderabad and Dr. R. K. Chowdhary, Jr. Entomologist, AICRPO, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Indore visited on 18 December 2007 to evaluate the Rabi 2007-08 safflower research programme.
27. Dr. Shailesh Waikar, Senior Engineer from Black and Dekker, U.S. visited on 27 December 2007 to explore the possibility of helping NARI in its rickshaw improvement program.

28. Dr. S. S. Inamdar and Mrs. Janhavi Inamdar of Sinhgad Institute of Technology, Lonavla visited NARI on 28 December 2007 to discuss with Dr. Rajvanshi about the research being carried out.
29. Dr. D. M. Hegde, Director, DOR, Hyderabad and Dr. S. K. Shinde, Breeder, AICRPO, Solapur visited the safflower programme on 6 January 2008.
30. A meeting of consortium partners of NAIP project on safflower was organized at NARI on 4 January 2008 to discuss the strategic planning and execution of the project. It was attended by Dr. Shilpa Gaikwad and Dr. Parag P. Joshi of B.Y.L. Nair Charitable hospital, Mumbai and Mr. Vaibhav Kulkarni, Mr. Anil Nalkande and Mr. Abhijit Ingole of Marico, Mumbai.
31. Smt. Vijaya Chauhan and Rahul, volunteers of the 'Narmada Navnirman Abhiyan' brought some students and their teachers of a residential school from Nandurbar and Jalgaon districts to see activities of the Animal Husbandry Division on 8 January 2008.
32. Twenty six participants of the 'National Training on Goat Farming' organized by Directorate of Extension Education of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, District Rantnagiri visited the Animal Husbandry Division on 19 January 2008.
33. Students of the Yashwantrao Chavan School of Social Work, Satara, Maharashtra visited the Animal Husbandry Division on 21 January 2008.
34. Twenty six students from Kashibai Navale College of Engg., Vadgaon (BK), Pune together with their professor Mr. Milind Mali visited NARI on 3 February 2008 and were shown the facilities and research program.
35. Prof. S. S. Nevase visited with 15 students of the College of Engineering, Pandharpur on 10 February 2008 to see the renewable energy activities at NARI.
36. Mr. Ashok Dongre-a well known cartoonist from Vile Parle, Mumbai visited NARI on 14 February 2008 to meet Dr. Rajvanshi and see the institute activities.
37. Dr. P. G. Adsule, Director, National Research Center on Grapes, Manjari (BK), Pune visited NARI on 16 February 2008 to see the APEDA-grape variety evaluation trial.
38. A visit to the Animal Husbandry Division of teachers from 10 schools each from Maharashtra and Goa was organized by the Bharati Vidyapeeth Institute of Environment Education and Research, Pune through their 'Biodiversity Project' on 17 February 2008.
39. Dr. B. S. Rana and Mr. Hemraj Bhandari of NFCL visited NARI on 1 March 2008 to see the sweet sorghum field trials.
40. Mr. M. S. Panhale, Divisional Seed Certification Officer, Ahmednagar, Mr. P. S. Malkani, AM (P), National Seeds Corporation, Pune and Mr. J. P. Patil, A.O.S.C.A., Satara visited NARI on 17 March 2008 to inspect and certify all the safflower seed production plots.

41. Six batches of 20-25 agricultural graduates each visited the Animal Husbandry Division under the “Agri Clinics and Agri Business” Training Program conducted by MITCON Consultancy Services Ltd., Pune during the year.

## **VI. VISITS BY STAFF**

1. Mr. K. M. Chavan and Mr. R. T. Khanvilkar visited the ‘Keshar Mati Agricultural Exhibition 2007’ organized by Solapur District Central Co-op Bank Ltd. at Pandharpur, Maharashtra on 14 April 2007.
2. Dr. V. Singh visited National Bureau of Plant Genetic Resources (NBPGR) to see the safflower germ plasm in the field on 18 April 2007. He also visited the National Research Center on Plant Biotechnology at Pusa and held discussions with Dr. S. R. Bhat regarding apomixis in safflower.
3. Mr. N. M. Kolekar and Mr. S. V. Choudhari visited Yadav brothers in Wing, Yerawle (Tal. Karad) on 21 June 2007 to see the sugarcane syrup business being run by them.
4. Mr. K. M. Chavan attended a workshop cum seminar on ‘Animal Nutrition’ held jointly by Hindustan Feeds Manufacturing Company, Satara and American Soybean Association at Phaltan on 25 July 2007.
5. Dr. Anil K. Rajvanshi visited the L. V. Prasad Eye Hospital at Hyderabad and had discussions with Dr. Balasubramaniam – its Director in September 2007.
6. Dr. V. Singh attended Field day cum dialogue on sweet sorghum for private sector scientists and entrepreneurs on 29 September 2007 at NRCS, Hyderabad.
7. Mr. S. V. Choudhari visited the International Agricultural Exhibition organized jointly by “Agrowon” and Mahatma Phule Agricultural University on 18 November 2007.
8. Dr. Chanda Nimbkar attended the inaugural program of ‘Woolen Expo 2007’ organized by Punyashlok Ahilyadevi Maharashtra Sheep and Goat Corporation Limited at Pune on 12 December 2007.
9. Ms. R. Sumitha, Jr. Pathologist visited the AICRP (Safflower) centers at Tandur, Solapur, Phaltan and Annigeri as one of the members of the safflower monitoring team from 1-8 January 2008.
10. Mr. M. B. Deshpande and Ms. R. Sumitha carried out a survey on 31 January and 1 February 2008 in Satara and Sangli districts for safflower disease assessment.
11. Mr. S. V. Choudhari visited Sugarcane Research Station at Padegaon on 18 February 2008 to attend the “Shivar pheri” program on the occasion of their completion of 75 years. He received latest information on sugarcane cultivation practices.

12. Dr. V. Singh attended Germplasm Field Day for safflower organized by Directorate of Oilseeds Research, Hyderabad on 22 February 2008.
13. Dr. Chanda Nimbkar, Dr. P. M. Ghalsasi and Shri R. T. Khanvilkar participated in the 'National Goat Fair and Scientists-Entrepreneurs-Farmers Interactive Meet' on 1-3 March 2008 at the Central Institute for Research on Goats, Makhdoom (near Mathura), Uttar Pradesh. Eight male and three female Boer goats and three Damascus cross males were shown in the exhibition at the fair. There was good response to the Boer goats.

## **VII. HONOURS**

1. The Bombay Veterinary College Alumni Association felicitated Dr. P. M. Ghalsasi on 2 August 2007 on the occasion of the 122<sup>nd</sup> Foundation Day of the College, for his research and development work in sheep and goats.

## **VIII. OTHER ACTIVITIES**

1. The Animal Husbandry Division has developed a grafting technique for propagating a hybrid of *Leucaena leucocephala* (KX2). The hybrid KX2 is psyllid-resistant, fast growing and a source of high protein supplementary feed for animals which can help to reduce expenditure on concentrate feed. The grafting technique involves the grafting of KX2 on K8 *Leucaena* plants. The AHD has achieved good success with this technique. The grafts developed are named 'NARI Nirbeeja'. The AHD has now made available 'NARI Nirbeeja' grafted plants and bud wood for sale.
2. Two patents of NARI on low concentration ethanol stove and lantern have been purchased by Nagarjuna Fertilizers and Chemicals Ltd (NFCL), Hyderabad. NFCL will hopefully manufacture and sell these stoves and lanterns.
3. Two project proposals on safflower flowers submitted to NABARD and NAIP during the year are under consideration for financial assistance.

## **IX. APPOINTMENTS**

1. Dr. Chanda Nimbkar was appointed the Chairperson of the NGO Rural Agricultural Institute Narayangaon (RAIN), at Narayangaon, Dist. Pune on 29 July 2007. She is one of the trustees of this institute. This institute introduced the Saanen dairy goat in India.

[HOME](#)

August 2008