

ANNUAL RESEARCH REPORT

2009-2010



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P.O. Box 44, PHALTAN-415523,
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Nimbkar Agricultural Research Institute (NARI), Phaltan

ANNUAL RESEARCH REPORT 2009-10

Report of the President



Welcome to the 2009-10 Annual Research Report of NARI.

We report on new projects, publications, research highlights and other activities.

A major highlight of the year was the receipt of Globe Sustainability Research Award by NARI. It was accepted by the inventor of the device 'Lanstove' Dr. Anil Rajvanshi at the hands of H.R.H. Crown

Princess Victoria of Sweden in a glittering ceremony in Stockholm on 4th June 2009. Award details are at this [website](#).

Dr. Rajvanshi was also honoured by being invited to give the prestigious B. D. Tilak memorial lecture at the National Chemical Laboratory (NCL), Pune. His lecture entitled "Renewable Energy for Sustainable Development" was delivered on 22 May 2009.

Marico Industries Ltd. – a leading Indian group in consumer products and services is also a leader in marketing refined safflower oil and its various blends. It is a significant buyer of the marketable safflower crop in India. Recently it has commenced contract farming in safflower. Apart from price guarantees their CSR initiative also envisages providing credit for seeds for sowing and technical guidance throughout the crop cycle. This initiative has a wide reach touching the lives of around 20,000 farmers. Marico commissioned a varietal evaluation trial at NARI during last Rabi and based on its results, showing 5-6% higher oil content in NARI varieties, has shown interest in future collaboration. We are very happy to make use of this opportunity to popularize safflower varieties produced by us.

The Institute also got another international acclaim for the development and dissemination of the more productive twinning NARI Suwarna strain of Deccani sheep. Dr. Chanda Nimbkar was invited by the FAO first to write a case study of the 'Development of NARI Suwarna' for an FAO document on the use of livestock biotechnology in developing countries. The FAO then invited her to present this case study which was one of the only three such case studies selected for the session on the "successful application of biotechnologies in the livestock sector in developing countries" in an important international conference on agricultural biotechnologies in developing countries (ABDC-10) held in Guadalajara, Mexico on 1-4 March 2010.

We are proud to report that a one hour programme on renewable energy entitled "Shell dialogues" was broadcast on NDTV last December. Dr. Rajvanshi was one of the five panelists and a six-minute clip on NARI was also shown during the programme. This gave good national exposure to work done at NARI. The NDTV clip is available on [YouTube](#).

Another exciting development this year was the sanctioning of loans of Rs. 50,000 each by the State Bank of India, Agriculture Development Branch, to 12 smallholder shepherds in Bhadali village, 20 km from Phaltan, to buy sheep. They decided to purchase FecB gene carrier NARI Suwarna ewes and the AHD supplied 94 pregnant heterozygous ewes to them. This is the first time that ewes of the new NARI Suwarna strain developed by NARI were demanded in such large numbers by local shepherds and the AHD was in a position to supply that number of good quality animals. This is validation of AHD's research by the local shepherd community for whose benefit it was carried out.

Two new research projects with Indian government funding started at the AHD this year and the AHD has entered new areas of work under both projects. In the goat project we are gaining an understanding of the village goat keepers' production system and economics.

We have to regretfully report that the Centre for Sustainable Development (CSD) could not become operational as expected in April 2010. Though major work has been completed, finishing is taking much longer than envisioned with an expected delay of about six months.

This year we had a record number of interns and all of them contributed in different ways to further the objectives of NARI. I sincerely wish to thank all of them for not only the work done by them, but also for enriching the atmosphere at NARI by their experiences.

Finally, I would like to gratefully acknowledge the generous donations of Rs. 5,00,000 from Nimbkar Seeds Pvt. Ltd. (NSPL) and Rs. 20,000 from Mr. P. C. Verma respectively for the Centre for Sustainable Development (CSD). We are extremely grateful to them and all other large and small donors to the CSD.

We also thankfully acknowledge donations of Rs. 12,300 and Rs. 1,000 respectively from Shri. Sachchidanand Vanungare from U.S. and Mr. Patrick Guimbeau from Mauritius to the corpus of NARI. Many gifts in kind were also received for the centre and I wish to say here how much we appreciate them. The details are given in the report.

Dr. N. Nimbkar
President

August 23 , 2010

AGRICULTURAL RESEARCH

SAFFLOWER

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.

Research highlights :

I. BREEDING :

1. **Development of cytoplasmic male sterility system through interspecific crossing :** The cytoplasmic male steriles developed through interspecific crossing as well as induced by streptomycin treatment were crossed in Rabi 2008-09 with sib-pollinator parents which had expressed high male sterility in their progenies. During Rabi 2009-10 about 44 pairwise crosses made with sib-pollinator parents were screened to identify the genotypes maintaining male sterility of the sterile cytoplasm. None of the crosses evaluated gave 100% male sterility in the sterile cytoplasm.
2. **Evaluation of CMS-based crosses :** About 70 diverse genotypes were crossed with the CMS lines with an objective of identifying genotypes which could maintain male sterility or restore fertility to the CMS lines. The evaluation of these crosses for sterility/fertility during flowering of the crop revealed that none of the 70 crosses examined showed complete maintenance of male sterility in the male sterile cytoplasm. However, one of the crosses exhibited complete restoration of fertility to the male sterile cytoplasm. This cross is CMS X PBNS-52.
3. **Evaluation of thermosensitive genetic male sterility (TGMS) in safflower :** The thermosensitive genetic male sterility system developed at the center was also evaluated during Rabi 2009-10 to assess its stability over the years. About 80 lines out of the 307 evaluated exhibited 100% male sterility. These lines will be maintained in summer 2010 for further use in hybrid development.
4. **Evaluation of thermosensitive genetic male sterility (TGMS)-based hybrids in safflower :** About 143 hybrids were evaluated during Rabi 2009-10. These hybrids were evaluated in four different trials, two of them carried out under partially irrigated conditions and the remaining two under irrigated conditions. In trial 1, 10 hybrids out of 38 evaluated gave higher seed yield than the best check CMS-based hybrid NARI-H-15 (2329 kg/ha). The hybrid TGMS-H-138 recorded the significantly highest seed yield of 2905 kg/ha which was 25% more than that of NARI-H-15.

In trial 2, carried out under partially irrigated conditions five hybrids of the 21 screened recorded higher seed yield than the best check CMS-based hybrid MRSA-521. The maximum increase in seed yield of 12.13% over the best check MRSA-521 was given by the hybrid TGMS-H-123, which was closely followed by the hybrid TGMS-H-137 (11.53%).

In trial 3 carried out under irrigated conditions 25 hybrids of the 40 screened recorded higher seed yield than the best check NARI-NH-1. The hybrid TGMS-H-177 recorded the maximum increase of 73% in seed yield over the best check GMS-based non-spiny hybrid NARI-NH-1 which was followed by the hybrid TGMS-H-182 (55%) and TGMS-H-224 (44%).

In trial 4, also carried out under irrigated conditions 10 hybrids out of the 44 screened recorded higher seed yield than the best check NARI-NH-1. The maximum seed yield increase over NARI-NH-1 was recorded by the hybrid TGMS-H-225 (50%) which was followed by the hybrids, TGMS-H-184 (37%) and TGMS-H-219 (31%).

5. **Seed production of promising TGMS-based hybrids under nylon cages :** Seed production of six promising TGMS-based hybrids viz. TGMS-H-38, 39, 42, 80, 83 and 104 was taken up under nylon cages by utilizing honey bee colonies. Sufficient amount of seed from each crossing block was obtained for further evaluation in coordinated multilocation trials. Seed production of TGMS-H-104 was also taken up at Indore which has cooler climatic conditions than those at Phaltan. About 5 kg hybrid seed was obtained from the seed production plot of 10 m² area at Indore. Seed production of NARI-TGMS-H-80 was taken up at Raipur, but it could not be successful due to delayed sowing which caused restoration of fertility in some of the TGMS plants. Seed production of NARI-TGMS-H-104 taken up at IARI Regional Research Station, Wellington, Tamil Nadu in April 2009 was also unsuccessful due to poor seed set mainly because of heavy infestation of foliar diseases during flowering and post-flowering period of the crop.

6. **Crossing programme :**

- (a) About 25 crosses were attempted among F₂ populations of two crosses segregating for normal and short-duration plants with a view to develop short-duration safflower with high number of capitula and other traits of normal safflower.
- (b) Forty hand-crosses were made between thermosensitive genetic male sterile lines as females and different genotypes as males to produce TGMS-based hybrids in safflower.

7. **Early and advance generation selections :**

- (a) F₂ populations of two crosses made between short-duration genotype WR-1-147-2-2 and normal-duration genotypes D-149-15-2-22 and D-149-39-2-6 were grown each in a 90 m² area. About 200 short-duration and normal-duration plants were selected from each cross for generation advancement.
- (b) Four hundred thirteen F₃ populations were evaluated for seed yield and other traits during the season. Of them 104 entries recorded more than 20% increase in seed yield over the respective best checks in different trials.

- (c) About 23 F₅ selections and 363 F₇ selections were screened for seed yield and its components during the season. This resulted in identification of 52 selections giving higher seed yield than the respective best checks in the concerned trials.
- (d) One hundred and fifty five germplasm lines received from Germplasm Management Unit at Directorate of Oilseeds Research, Rajendranagar, Hyderabad were screened under minimal irrigation in black soils which resulted in identification of 20 entries giving higher seed yield than the best check Bhima.
- (e) Out of 363 high oil F₇ selections screened in 12 trials, 44 selections recorded higher seed yield than the best checks in respective trials.
8. **Development of high seed and oil-yielding safflower cultivars :** Nine out of the 96 high oil-containing entries evaluated in the preliminary varietal trials recorded higher seed yield than the best checks in the respective trials. Two safflower varieties viz. NARI-52 and NARI-57 which were evaluated in the Advanced Varietal Trial during Rabi 2008-09 recorded 36 and 31% increase in oil yield over the best check across the locations under irrigated conditions and were promoted to third year of evaluation in AICRP trials. In addition, NARI-63 which was evaluated in IVT during 2008-09 recorded 25% increase in oil yield over the best check A-1 across the locations and was promoted to AVT-I for second year of evaluation.
9. **Coordinated varietal trials :**

Among the three coordinated varietal trials, out of the 25 entries in IVT, only one entry namely SSF-658 (C) (Solapur) recorded significantly higher seed yield than the local check NARI-38. In IHT, entry NARI-H-23 recorded the maximum seed yield of 1630 kg/ha which was followed by the entries NARI-H-22 (1488 kg/ha) and NARI-H-15 (1457 kg/ha). The differences between entries were non-significant for seed yield. Out of the 13 entries in AVT-I&II, eight entries recorded numerically higher seed yield than the local check NARI-38. The maximum seed yield of 1196 kg/ha was recorded by the entry NARI-55 which was followed by the entries NARI-63 (1138 kg/ha) and NARI-56 (1111 kg/ha). The differences among the seed yields of the entries were non-significant.

The center produced 15 kg breeder seed of safflower variety NARI-6, 20 kg breeder seed of MMS, the female parent of NARI-NH-1 and 150 kg breeder seed of C-2829-5-3a-6, the male parent of NARI-NH-1. In addition, 100 kg breeder seed of GMU-2369, the male parent of NARI-H-15 was produced during the season. One hundred kg hybrid seed of NARI-NH-1 and 140 kg seed of NARI-H-15, besides 139 kg seeds of Nira were also produced during the season.

II. AGRONOMY :

1. Yield maximization in safflower :

The non-spiny hybrid NARI-NH-1 was planted on November 8 by following the recommended package of practices for maximizing its seed yield. Due to delayed sowing of the trial owing to extended rains at Phaltan a low seed yield of 1031 kg/ha and net returns of Rs. 5629/ha were obtained from the trial.

2. Phosphorus management in safflower-based cropping system :

The results of the trial showed differences due to phosphorus levels to be non-significant for seed yield, gross returns, net returns and benefit : cost ratio in safflower and soybean.

The pooled analysis of the trial carried out from 2005-06 to 2009-10 for soybean and safflower revealed that differences due to treatments were significant for seed yield, gross returns, net returns and benefit cost ratio in both soybean and safflower. Significantly highest safflower seed yields were obtained where 100% P, 50% P + PSB, 50% P, 5 T FYM/ha or PSB + 5 T FYM/ha was given to safflower with 50% or 100% P, 50% P + PSB, no P, 5 T FYM/ha or PSB + 5 T FYM/ha to soybean.

3. Integrated nutrient management in safflower-based cropping system :

The results of the trial showed significant differences due to treatments for seed yield and gross returns for soybean. In safflower also differences due to treatments were found to be significant for seed yield, gross returns, net returns and benefit cost ratio. Application of 50% N + 100% P to safflower followed by 100% NP to soybean recorded the maximum seed yield in soybean of 2233 kg/ha. Six other treatments were on par with it. Significantly highest seed yield and net returns in safflower were obtained where soybean was given 50% or 100% NP followed by 100% NP to safflower.

The pooled analysis of the data of the trial carried out from 2005-06 to 2009-10 for safflower and soybean revealed that differences due to treatments were significant for seed yield, gross returns and benefit : cost ratio. 100% NP application to safflower with either 50% NP, 100% NP or 100% N + 50% P + PSB to soybean gave significantly highest seed yield, gross returns and benefit : cost ratio in safflower.

4. Response of AVT-II entries to fertilizer application :

The results of the trial indicated that differences due to varieties were not significant for seed yield and harvest index (%). Differences due to varieties were significant for biological yield, gross returns, net returns and benefit : cost ratio with the entry NARI-52 recording the significantly highest values for all. Significantly highest seed yield was obtained when 100% recommended fertilizer dose was used.

5. Evaluation of AVT-II entries under different sowing dates (Irrigated) :

Sowing on the two dates in October could not be carried out due to heavy rains. The results of the trial showed that differences due to sowing dates and varieties were non-significant for seed yield, biological yield, gross returns, net returns, benefit : cost ratio and harvest index

(%). Entries AKS-307 (Akola), NARI-55 and AKS/GMU-2724 (Akola) were the highest yielding entries for November 8 planting date while for November 25 planting date NARI-52, A-1 (National Check) and NARI-56 had the highest seed yield. The latter three also gave the highest average seed yield over the two sowing dates.

6. Assessment of fertilizer recommendation for safflower :

The results of the trial indicated that safflower responded significantly to N but not to P. The significantly highest seed yield of 2177 kg/ha was recorded by the application of 90 kg/ha of N which was on par with the application of N @ 60 kg/ha. This treatment also recorded the highest net returns and benefit : cost ratio in the trial. Interaction effect was not significant.

7. Comparative assessment of yield gain from safflower hybrids in relation to fertilizer inputs :

The results of the trial showed that the differences due to fertilizer levels and varieties/hybrids were significant for seed yield, gross returns, net returns, benefit : cost ratio and plant height. Among the cultivars, safflower hybrid NARI-H-15 recorded the significantly highest seed yield of 2468 kg/ha across the fertilizer dosages applied, while 100% and 150% recommended dose of fertilizers gave the significantly highest seed yield over all the genotypes. Same trend was noticed for gross returns, net returns, benefit : cost ratio and plant height.

III. PATHOLOGY :

Under the plant pathology programme, 71 farmers' fields were surveyed in three talukas in Satara district, two in Sangli district and one in Pune district. The *Alternaria* disease intensity varied from 1 to 10% and wilt disease intensity was less than 1%.

None of the 437 germplasm entries screened against *Alternaria* leaf spot were found to be tolerant to it. Among the 44 elite varieties and hybrids, 12 were found to be immune to *Alternaria* leaf spot.

Among the 10 germplasm entries screened against *Fusarium* wilt two were tolerant and four were immune. Among the 44 elite entries screened against wilt, two were immune, 15 along with check NARI-38 were moderately resistant and seven tolerant. Out of the 155 single plant selections of F₃ generation 13 were found to be immune to wilt.

Seven different fungicides were evaluated for their efficacy against *Alternaria* leaf spot. Plots treated with Difenconazole @ 0.05%, SAAF and Hexaconazole @ 0.1%, Chlorothalonil @ 0.2% and Mancozeb @ 0.25% were found to have significantly lowest disease severity.

Eight fungal and bacterial bioagents were screened in dual culture studies against root rot of safflower caused by *Macrophomina phaseolina*. Out of them isolate of *Bacillus subtilis* gave 74% inhibition of *M. Phaseolina* and also high vigour index in blotter study. Seed dressing with cultures of *Trichoderma viride* and *Trichoderma harzianum* gave high seed germination in pot studies.

MARICO Industries-sponsored trial on “Evaluation of promising and released safflower cultivars developed at NARI”

A trial comprising of three high oil-containing promising genotypes and three released cultivars from NARI and two checks A-1 (national) and Bhima (local) was laid out in a randomized block design with three replications with an objective to identify the cultivars giving seed yield at par with the check but with a 5-6% higher oil content. The sowing of the trial was done on December 14, 2009. The results of the trial showed that the differences between cultivars evaluated were non-significant for seed yield, final plant stand, plant height, number of capitula/plant and capitulum diameter. The numerically highest seed yield of 1115 kg/ha was recorded by the non-spiny hybrid NARI-NH-1 which was followed by the checks A-1 (1087 kg/ha) and Bhima (1077 kg/ha). The high oil-containing promising cultivars NARI-52 and NARI-57 also recorded high seed yields of 1027 and 1006 kg/ha respectively.

Thus the study revealed that the productivity of the high oil-containing genotypes is comparable to that of the checks. The oil analysis carried out by Marico Industries showed that the maximum oil content of 35% was in safflower entry NARI-57 which was followed by the entry NARI-52 (33%). The checks A-1 and Bhima showed an oil content of 29 and 30% respectively. The availability of higher oil content in NARI entries will result in higher oil productivity from them. This will also generate more income to farmers if an enhanced price is given for the produce containing higher oil content, as is intended by Marico Industries.

NARI - NH – 1 at Shri
Vithal Baburao Rasal’s farm
at Deulgaon, Dist. Pune



SWEET SORGHUM

All India Co-ordinated Sorghum Improvement Project (Sweet Sorghum)

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

NARI is one of the centers of All India Co-ordinated Sorghum Improvement Project (AICSIP) for sweet sorghum research since April 2009. The major objective of sweet sorghum improvement at NARI has been to develop high biomass and high sugar-yielding varieties and hybrids.

Objectives :

1. Development of sweet sorghum CMS lines.
2. To assess the performance for high biomass and sugar content in :
 - a. CMS-based sweet sorghum hybrids.
 - b. Promising Kharif (rainy season) land races.
 - c. Promising germplasm lines.
 - d. Promising ICRISAT germplasm lines.
 - e. Promising sweet sorghum genotypes.

Research highlights :

The investigations undertaken in the project are described below. In all the trials Madhura, RSSV-9 and SSV-84 were used as checks unless mentioned otherwise.

Kharif (Rainy season) 2009 :

1. In order to identify high-yielding CMS-based sweet sorghum hybrids for Kharif conditions, a total of 47 hybrids were evaluated during Kharif-2009 in two different trials. Twenty six hybrids were evaluated in trial-1A. Out of these, hybrid SSRH-171 gave significantly highest fresh biomass yield of 52.30 T/ha with that of the best check SSV-84 being 35.39 T/ha. SSRH-171 was followed by SSRH-162 (50.63 T/ha) and SSRH-156 (50.33 T/ha). The maximum total sugar index of 2.39 T/ha was recorded by SSRH-174 which was followed by SSRH-156 (2.06 T/ha) and SSRH-171 (2.04 T/ha).
2. Another set of 21 CMS-based sweet sorghum hybrids (Trial-1B) were evaluated with the same objectives as in trial-1A. The significantly highest fresh biomass yield of 47.44 T/ha was produced by SSRH-178 followed by SSRH-187 (47.43 T/ha), with the best check RSSV-9 producing 41.35 T/ha. The maximum total sugar index of 1.94 T/ha was recorded by SSRH-179.
3. A total of 44 CMS-based sweet sorghum hybrids were also evaluated in two different trials. In trial-2A, out of 20 CMS-based sweet sorghum hybrids, the hybrid SSKH-5 gave significantly highest biomass yield of 56.42 T/ha with the best check RSSV-9 giving 40.75 T/ha. SSKH-5 was followed by SSKH-4 (53.96 T/ha) and SSKH-17 (53.92 T/ha). The highest total sugar index of 1.84 T/ha was recorded by the hybrid SSKH-4 (1.84 T/ha).

4. In trial-2B, out of 44 CMS-based sweet sorghum hybrids evaluated with the same objectives as in trial-2A, the significantly highest fresh biomass yield of 70.97 T/ha was recorded by SSKH-30 with the best check RSSV-9 giving yield of 46.65 T/ha. The maximum total sugar index of 2.01 T/ha was recorded by SSKH-35 which was followed by SSKH-30 (1.99 T/ha).
5. Another set of eight CMS-based sweet sorghum hybrids was evaluated for high biomass and sugar yield. The significantly highest fresh biomass yield of 50.82 T/ha was recorded by SSH-4 with the best check Madhura giving 41.62 T/ha. The maximum total sugar index of 1.82 T/ha was given by SSH-4 followed by SSH-13 (1.69 T/ha) and SSH-9 (1.42 T/ha) with the best check RSSV-9 giving 1.19 T/ha.
6. A total of 26 landraces collected from farmers' fields during 2008 were also evaluated. The maximum biomass yield of 50.85 T/ha was recorded by NARI-LC-K-07-10 which was followed by NARI-LC-K-07-12 (47.34 T/ha) with the best check Madhura giving 35.65 T/ha. The maximum juice yield of 16.10 T/ha was recorded by genotype NARI-LC-K-07-10 which was followed by NARI-LC-K-07-27 (13.53 T/ha). Therefore, NARI-LC-K-07-10 gave high biomass as well as juice yield.
7. Out of 31 ICRISAT germplasm lines evaluated for high biomass and sugar yield, the maximum fresh biomass yield of 47.40 T/ha was recorded by IS-8988 with the best check Madhura giving 43.83 T/ha. The maximum juice yield of 12.12 T/ha was recorded by IS-5210 with that of best check SSV-84 being 9.24 T/ha. IS-5210 was followed by IS-3962 (11.60 T/ha) and IS-2292 (11.31 T/ha).
8. A trial comprising of 17 genotypes identified as promising along with two checks viz. Madhura and RSSV-9 was carried out for identifying those with high biomass and sugar content. The maximum fresh biomass of 51.15 T/ha was recorded by IS-40013 with the best check RSSV-9 giving 29.64 T/ha. The maximum juice yield of 12.08 T/ha was recorded by IS-39486, which was followed by IS-40013 (11.08 T/ha). Therefore, IS-40013 gave both high biomass and juice yields.
9. In continuing sweet sorghum CMS-line development programme, we have made 51 crosses between the individual F₃ selections among A lines exhibiting complete male sterility and the corresponding maintainer genotypes to further assess the male sterility maintenance ability of newly identified B lines. The CMS lines being considered for improvement are NARI-SS-5A, NARI-SS-6A and NARI-SS-11A-6.
10. F₄, F₅, F₆ and F₇ selections of different crosses were evaluated for their yielding ability and sugar content in different trials planted in randomized block design. The individual selections included in these trials were selected based upon their high biomass, high juice yield and brix % in juice.
11. A crossing programme consisting of nine sweet sorghum CMS lines and 11 genotypes possessing desired traits was laid out in a line x tester manner to develop sweet sorghum hybrids giving high biomass and sugar. The genotypes used as parents in the crossing programme were as follows.

Lines: ICSA-34, ICSA-423, ICSA-432, ICSA-448, ICSA-459, ICSA-467, ICSA-525, ICSA-584, ICSA-685

Pollinators: NARI-SS-22, NARI-SS-130, NARI-LC-07-6, NARI-LC-07-30, IS-147, IS-2162, IS-8100, IS-8722, IS-8922, IS-19512, SSV-84.

Rabi (Post-rainy season) 2009-10 :

1. A Total of 36 CMS-based sweet sorghum hybrids were evaluated for high biomass and sugar content. Out of them the significantly highest biomass yield of 56.70 T/ha was given by the hybrid SSRH-180 with that of the best check Madhura being 42.98 T/ha. SSRH-180 was followed by SSRH-173 (52.28 T/ha). The maximum total sugar index of 1.6 T/ha was recorded by SSRH-182 which was followed by SSRH-172 (1.45 T/ha) with the best check SSV-84 giving 1.1 T/ha.
2. Another set of 40 CMS-based sweet sorghum hybrids was evaluated in two different trials (Trial-2 and 3) for high biomass and sugar content. In trial-2, out of 20 CMS-based sweet sorghum hybrids evaluated, significantly highest biomass yield of 72.94 T/ha was recorded by SSKH-79 with the best check Madhura yielding 65.42 T/ha. SSKH-79 was followed by SSKH-70 (65.20 T/ha). The maximum total sugar index of 2.5 T/ha was recorded by SSKH-79 which was followed by SSKH-72 (1.23 T/ha).
3. In trial-3, 20 CMS-based sweet sorghum hybrids were evaluated. The significantly highest fresh biomass yield of 55.17 T/ha was recorded by SSKH-84 with the best check Madhura giving 46.55 T/ha. SSKH-84 was followed by SSKH-94 (53.94 T/ha), SSKH-95 (53.72 T/ha) and SSKH-85 (49.66 T/ha). The maximum total sugar index of 2.03 T/ha was recorded by SSKH-94 which was followed by SSKH-84 (1.21 T/ha).
4. Out of 226 station germplasm lines evaluated under limited irrigation for drought tolerance, the maximum fresh biomass yield of 64.38 T/ha was recorded by NARI-SS-75 with the best check SSV-84 yielding 38.18 T/ha. NARI-SS-75 was followed by NARI-SS-135 (47.95 T/ha), NARI-SS-125 (44.4 T/ha) and NARI-SS-40-1, NARI-SS-40-2, NARI-SS-44-1, NARI-SS-49 and NARI-SS-119 (all 43.96 T/ha). The maximum juice yield of 17.18 T/ha was recorded by NARI-SS-75 with the best check SSV-84 giving a juice yield of 9.63 T/ha. NARI-SS-75 was followed by NARI-SS-119 (14.27 T/ha), NARI-SS-183 (12.94 T/ha) and NARI-SS-160 (12.68 T/ha). Therefore our varieties NARI-SS-75 and NARI-SS-119 were the most promising.
5. Out of the 135 ICRISAT germplasm lines evaluated for desired traits, the maximum fresh biomass yield of 44.4 T/ha was recorded by IS-39027 with the best check Madhura giving 38.18 T/ha. IS-39027 was followed by entries IS-38465 (43.96 T/ha), IS-40081 (43.07 T/ha) and IS-21006 (42.62 T/ha). The maximum juice yield of 13.96 T/ha was recorded by IS-36520 with the best check Madhura giving 10.06 T/ha. IS-36520 was followed by IS-20720 (11.72 T/ha).



6. Seed production of five promising CMS-based sweet sorghum hybrids viz. NARI-SSH-44, NARI-SSH-52, NARI-SSH-35, SKH-8 and SKH-67 was undertaken, but due to heavy rainfall especially during flowering only two of the hybrids gave a good seed set under paper bags. Sufficient amounts of seed of these hybrids were obtained for further evaluation in multilocation trials in Kharif-2010.

AGRONOMY TRIALS

1. Comparison of application of urea-DAP briquettes with standard fertilizer application method in sweet sorghum and safflower :

The trial was planted on 10 October 2009.

The treatments were as follows :

- (1) Urea-DAP briquettes (70 kg N + 35 kg P/ha) at the time of planting.
- (2) Standard fertilizer (urea + SSP) containing 50 kg N + 50 kg P/ha at the time of planting + 50 kg N at 25 days after planting.
- (3) 30% lower standard fertilizer containing 35 kg N + 35 kg P/ha at the time of planting + 35 kg N at 25 days after planting (equivalent to Urea-DAP briquettes).

No statistically significant differences were found between the treatments for seed yield in safflower or seed and biomass yield in sweet sorghum. Therefore, it can be concluded that present rates of fertilizer application to both safflower and sweet sorghum can be reduced by 30% without any yield reduction. Also it is feasible to apply the urea-DAP briquettes only at the time of planting making it unnecessary to carry out split application of the nitrogen dose.

2. Effect of Amrutpani on sweet sorghum :

Amrutpani is an organic mixture. For one acre 10 kg fresh cowdung, 10 litres cow urine and 100 g jaggery are mixed and left to ferment for 8-10 days. Then it is diluted with 10 times the quantity of water and applied to the field 3-4 times at one-monthly intervals. This practice is quite popular among the organic farmers.

Sweet sorghum hybrid Madhura was used for the experiment with three treatments – 1) recommended chemical fertilizer 2) Amrutpani 3) recommended chemical fertilizer + Amrutpani. Unfortunately the trial sown on 10 February 2009 lodged after irrigation on 30 April 2009. Therefore it was harvested prematurely on 20 May 2009 and a ratoon kept with the same treatments being applied to the ratoon crop also.

In the prematurely harvested plant crop, chemical fertilizer treatment gave about 20% higher biomass weight than the Amrutpani treatment, while in the ratoon it was more than 60% higher. Also the brix of juice from Amrutpani-treated crop was 1 to 1.25 degrees lower than that of juice from the other two treatments. Thus application of only Amrutpani did not give yields comparable to those with chemical fertilizer at least over the short term.

3. Effectiveness of neem and water sprays in safflower pest control :

This trial was carried out in Rabi 2008-09 and 2009-10 to see the feasibility of growing safflower without using conventional treatments for the control of aphids (*Uroleucon compositae*).

In 2008-09 Safflower hybrid NARI-H-15 was used. The plants were either cut at 5 cm ground level at 40 days after sowing or left uncut. About 5 tonnes of fresh biomass per hectare was produced. Cut plants resprouted very nicely and would have produced a good seed crop if aphids could have been controlled. Neither water nor neem spray could give any aphid control. The sowing was carried out on 22 October and not during the recommended period of first fortnight of October. This also increased aphid infestation.

The trial was repeated in 2009-10 with NARI-NH-1, Bhima (state check) and A-1 (national check) taken in addition to NARI-H-15. Here again though sowing was carried out on 9 October which was during the recommended period, none of the cultivars showed any tolerance to aphids and as a result no seed could be produced. Neither water nor neem spray could control aphids to any significant extent.

4. To study the effect of population, fertilizer dose and cutting height on plant and ratoon crops of hybrid sweet sorghum Madhura :

Trial 1 : Date of sowing : 22 September 2009
Date of harvest : 27-29 January 2010

Plant populations : 3 - 1.1 lakh/ha (plant to plant spacing 20 cm)
1.5 lakh/ha ("- 15 cm)
2.2 lakh/ha ("- 10 cm)

Fertilizer doses : 4 - 0 kg N/ha
100 kg N/ha
200 kg N/ha
250 kg N/ha

Cutting heights : 3 - 5 cm above ground level
10 cm above ground level
15 cm above ground level

All the plots were given 50 kg P and K/ha at the time of planting with no basal dose of N.

As per treatment half N was given 3 weeks after planting and remaining half at early boot stage (about 2 months after planting).

This trial has been planted over three seasons.

Sr. no.	Date of sowing	Date of ratooning	Season
1.	22 September 2009	27-29 January 2010	Rabi
2.	12 February 2010	2-18 June 2010	Summer
3.	8 June 2010		Kharif

The data are presently being processed.

Project staff : N. Nimbkar, Ph.D.; D. R. Bapat, Ph.D. (Consultant); V. Singh, Ph.D.; M. B. Deshpande, M.Sc.; S. V. Choudhari, S. V. Burungale, M.Sc., A. A. Chavan, M.Sc.; J. H. Akade M.Sc.; Anaytullah Siddique, Ph.D.; C. S. Khore; M.Sc., A. M. Ranaware; M.Sc., T. V. Kotasthane, M.Sc.; V. A. Bhagwat, M.Sc.; S. D. Zagade, R. K. Andhalkar; D. S. Awati; A. M. Nale

RENEWABLE ENERGY RESEARCH

Most of the work was focused on two activities – lanstove and Sustainable Center.

LANSTOVE

Funding agency : Self-funded.

Major work included the following :

1. Solving the problem of soot formation in the ethanol lantern. Various internal geometries have been tried besides replacement of air as the pressurized gas with inert gas nitrogen.
2. Testing of the lantern in actual users' households. This was done by two interns Ms. Mariette McCampbell and Mr. Maarten Smit from the Netherlands.
3. Conversion from ethanol to kerosene-powered system. Because of problems with the excise department on the use of ethanol for household purposes it was thought prudent to run the lanstove on kerosene – a readily available fuel in rural areas. The results for this stove are excellent. Very good combustion has been achieved and hence no soot, smoke or any obnoxious gases are emitted. The CO levels in a closed room were < 3 ppm after 2-3 hours of cooking. Lab testing is continuing and we hope to field test this kerosene lanstove soon.



SUSTAINABLE CENTER

The construction of 1200 m² teaching and research facility called NARI-Bajaj Center of Sustainable Development (CSD) started in March 2009. The funds for center construction have been generously donated by Nimbkar Seeds Pvt. Ltd., Bajaj Foundation, Cummins Foundation and Housing Development Finance Corporation Ltd. (HDFC). The center which was supposed to have been finished by the end of March 2010 has been delayed because of problems with the contractor. It is hoped that it will be finished after a delay of six months.

The following activities have been done :

1. A nice website of the center was made by Dr. Christopher Reeve – an intern from the U.K. The website <http://www.nariphaltan.org/ncsd> gives in details the program for what NARI Center of Sustainable Development hopes to achieve.
2. A complete roof-top cooling system was designed by an American intern Mathew De Amico.



CSD building
nearing completion

3. A detailed discussion on the modules and teaching material to be covered was held with Shri. Satish Chilekar (one of the resource persons) and Dr. L. Ramakrishna – Director of Sustainable Research at Indsearch Management Institute in Pune.
4. All the basic furniture for the center has been designed and fabricated in the Institute workshop. This has resulted in tremendous savings to the Institute.
5. Funding for equipment required for the centre has been received. Thus we gratefully acknowledge the following :
 - (a) A 15 KVA genset donated by Kirloskar Oil Engines, Pune
 - (b) A 1.5 kW Solar-powered pumpset donated by Kirloskar Brothers, Pune
 - (c) An LCD Projector donated by Solaris, Pune

Project staff : Anil K. Rajvanshi, Ph.D., S. M. Patil, R. S. Bale, A. M. Pawar, D. B. Gadhawe. Interns : Mariette McCampbell (Groningen University, the Netherlands), Maarten Smit (Twente University, the Netherlands), Harsh Tilak (Mumbai University), Dr. Christopher Reeve (Sussex University, U.K.), Amit Bhojane and Vikram Kadam (IIT, Kharagpur), Regina Pavlovic (University of Konstanz, Germany), Matthew DeAmico (Portland, Oregon, U.S.A.).

Animal Husbandry Division (AHD)

LIVESTOCK RESEARCH

Project 1. Increasing profitability of sheep production by genetic improvement using the *FecB* (Booroola) mutation and improved management

Funding agency : Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India.

Collaborating Institute : National Bureau of Animal Genetic Resources of the Indian Council of Agricultural Research

Duration : 2009-12

This project is a follow-on project to the project funded by the Australian Centre for International Agricultural Research (ACIAR) for 10 years from 1998-2007. Under the ACIAR project,

Research highlights :

1. **Multiplication of *FecB* carrier animals in the nucleus flock :** Total 792 ewes were inseminated with fresh, diluted ram semen in three artificial insemination (A.I.) programmes from Nov. 2008 to Nov. 2009. The average number of ewes allotted to each ram was kept to only 10 to 11 in order to control inbreeding. These programmes were held in Nov. 2008, June 2009 and Nov. 2009. Out of the 550 ewes expected to lamb before 31 March 2010, 490 lambed and 638 lambs were born. The conception rates achieved in the first two programmes were 83.3% and 88.4% respectively. Out of the 306 lambs produced in May 2009, two *FecB* homozygous rams and two ewes and 20 *FecB* heterozygous rams and 73 ewes were retained on the basis of *FecB* genotype, growth rate and conformation. They will be selected further before their addition to the main breeding flock. The number of homozygous ewes is small because homozygous ewes were mostly mated to non-carrier Deccani or Madgyal rams in order to improve conformation to make the breed more acceptable to local shepherds.



**NARI
Composite ewe
with twin lambs
in the NARI
nucleus flock**

The breeding decisions were taken so as to balance the progress towards the achievement of three important goals: producing more *FecB* carrier animals for dissemination and for improving the selection intensity in the NARI nucleus flock, improving the physical appearance and conformation of *FecB* carrier animals through the introduction of Deccani

and Madgyal rams and controlling inbreeding so as to secure the long term future of the flock. Deccani rams borrowed from local smallholder flocks and purchased Madgyal rams were used to make the crosses more desirable to local smallholder sheep owners. Madgyal or Vijapuri is a breed from southern Maharashtra which is a tall breed with a faster growth rate than Deccani and is preferred by shepherds in the Phaltan and many other areas of Maharashtra. Breeding ewes and lambs were managed under a system of grazing with a small amount of supplementary feeding.

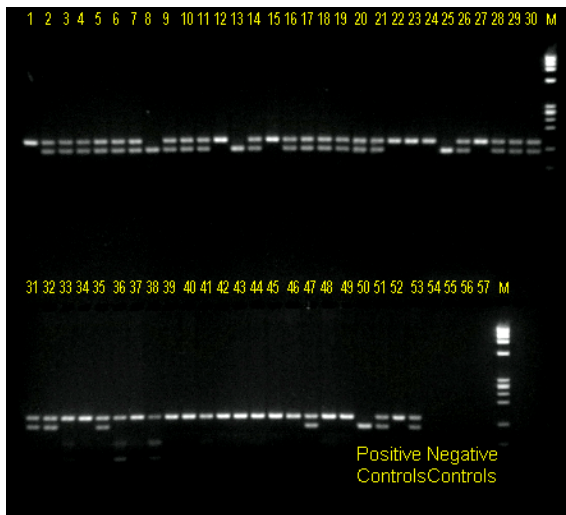
2. **Dissemination of FecB into local smallholder shepherds' flocks :** Ninety four heterozygous FecB gene carrier (FecB^{B+}) ewes were disseminated on 13 January 2010 to 12 smallholder sheep owners who are members of the Birdev Farmer Shepherds' Club in Bhadali village in the rainfed area of Phaltan taluka, south of Phaltan town. This club was promoted by NARI and registered in June 2008 under a scheme of the National Bank for Agriculture and Rural Development (NABARD). It was inaugurated formally on 31 August 2008. The sheep owners were given loans at 10.5% rate of interest by the State Bank of India, Agricultural Development Branch, Phaltan to buy the sheep. These 94 FecB carrier ewes with the ability to have twin lambs and 279 local Deccani non-carrier ewes owned by these smallholder shepherds are being performance-recorded by NARI's extension workers. All ewes and their lambs have ear tags for individual identification. Most of the 94 FecB carrier ewes were up to two months' pregnant at the time of dissemination and were personally selected by the shepherds.



Mr. and Mrs. Dattatray Pisal of Bhadali with one of their NARI Suwarna ewes and its twin lambs

3. **Establish PCR-RFLP DNA test for the detection of the FecB mutation :** A molecular biology laboratory was established at NARI-AHD by purchasing all the basic equipment. The PCR-RFLP DNA test for detection of the FecB mutation in sheep blood samples was established successfully in this laboratory. Four hundred and fifty nine sheep were tested during the year, out of which 56 were homozygous, 226 were heterozygous for the FecB mutation and 158 were non-carriers. The samples where the genotypes were doubtful were retested. Thus FecB genotypes of 96% of the samples were obtained at the first test and the remaining 4% after a repeat test.

Gel photo of one of the FecB genotyping PCR-RFLP tests of Garole and crossbred sheep DNA carried out at NARI, Phaltan



Lane 8 – *FecB* carrier Homozygous ($FecB^B / FecB^B$) at 110 bp
 Lane 2- *FecB* Heterozygous ($FecB^B / FecB^+$) at 140 bp and 110 bp
 Lane 1 - *FecB* non-carrier Homozygous ($FecB^+ / FecB^+$) at 140 bp

4. **Estimation of the effect of one and two copies of the *FecB* mutation:** The average litter size of homozygous ($FecB^{BB}$), heterozygous ($FecB^{B+}$) and non-carrier ewes was 1.60, 1.52 and 1.05 respectively in May 2009. In December 2009, it was higher i.e. 2.27, 1.86 and 1.13 respectively for homozygous ($FecB^{BB}$), heterozygous ($FecB^{B+}$) and non-carrier ewes respectively. A supplementary feeding trial was conducted during the AI program in July 2009. Ewes were divided equally into two groups, ensuring about half of the ewes of each *FecB* genotype were in each nutrition group. One group was given 50 g concentrate and 50 g maize every day (low nutrition) and the second group was given 100 g concentrate and 100 g maize every day (high nutrition). Ewes were fed in groups in feeders. It is therefore likely that variable amounts of concentrate and maize were consumed by each ewe daily. Litter size was analyzed statistically by fitting the fixed effects of ewe's *FecB* genotype, ewe's nutrition group, ewe's breed proportion and ewe's age. Ewe's *FecB* genotype was significant while ewe's breed proportion, ewe's age and ewe's nutrition group were not significant. The effect of *FecB* genotype was as expected i.e. homozygous ewes had the highest litter size; non-carrier ewes had the lowest litter size while heterozygous ewes were intermediate. The reason why nutrition group was not significant was probably that ewes were fed in groups and therefore individual intake of the supplementary feed was variable. However, the higher litter size in December 2009 as opposed to that in May 2009 can be attributed to the increase in ovulation rate due to a higher level of supplementary feeding received by some ewes at the time of breeding.

Table 12. Litter sizes of ewes of three *FecB* genotypes

Lambing dates	26 April – 29 May 2009				19 November – 22 December 2009			
Ewes having	Number of ewes of each <i>FecB</i> genotype of different lambing types				Number of ewes of each <i>FecB</i> genotype of different lambing types			
	BB	B+	++	Total	BB	B+	++	Total
Singles	18	66	60	144	13	37	59	109
Twins	13	59	3	75	22	71	9	102
Triplets	4	5	0	9	5	15	0	20
Quadruplets	-	-	-	-	11	2	0	13
Total	35	130	63	228	51	125	68	244

Usually roughly half of the $FecB^{BB}$ and $FecB^{B+}$ ewes have twins and about 10% of the $FecB^{BB}$ ewes and 5% of the $FecB^{B+}$ ewes have triplets while the remaining ewes have singles. However, because of the higher nutrition (flushing) received by some ewes during the July 2009 AI program, 30% of the $FecB^{BB}$ ewes and almost 14% of the $FecB^{B+}$ ewes had either triplets or quadruplets. This is not desirable as lamb mortality is high among triplet and quadruplet lambs. Therefore it can be concluded that *FecB* carrier ewes should not be given more than 100 g per day supplementary feeding at the time of breeding.

- 5. Analysis of expression profile of candidate/regulatory genes associated with fecundity: (Work carried out at our collaborating institute NBAGR using blood and tissue samples collected from animals at NARI-AHD) :** The expression profile in whole ovarian tissue of fecundity-related genes in *FecB* carrier and non-carrier ewes was studied by semi-quantitative RT-PCR and quantitative real-time PCR. Semi-quantitative RT-PCR technique was optimized using *GAPDH* as an internal control to analyze the relative expression pattern of eight genes across different *FecB* genotypes. RT-PCR showed varied levels of *BMP1B*, *BMP15*, *STAT5*, *SMAD5*, *SMAD9*, *FSHR*, *GDF9* and *LHCGR* gene expression across animals with different *FecB* genotypes and litter sizes.
- 6. Investigation of cost-effective management techniques under shepherd flock conditions :** It has been found that shepherds give the following kinds of supplementary feed to their growing lambs depending on availability.

Lucerne (*Medicago sativa*): about 1 kg fresh green matter per lamb per day

Marwel (*Dichanthium caricosum*): about 600 g fresh grass per lamb per day

Green maize fodder (*Zea mays*) : about 500 g per lamb per day

Some shepherds also give grain or concentrates to lambs such as maize, wheat and pearl millet (bajra) grains at 100 to 200 g per day. They find it cost-effective to feed the lambs because of the response they get in weight gain. Their costs are recovered and they earn a profit on the sale of lambs.

Principal Investigators :

1. Dr. Chanda Nimbkar, Director, AHD, NARI
2. Dr. B.P. Mishra, NBAGR, Karnal

Co-investigators :

1. Dr. Pradip Ghalsasi, Associate Director, AHD, NARI
2. Dr. R.S. Kataria, NBAGR, Karnal
3. Dr. B.K. Joshi, NBAGR, Karnal

Project staff : Ms. Sonali Saste, Ms. Padmaja Ghalsasi, Mr. Rupchand Khanvilkar, Mr. Dilip Bhandari, Mr. Ashok Magar, eight shepherd men and women and seven farm labourers.

Project 2. Osmanabadi Goat Field Unit under the All India Coordinated Research Project on Goat Improvement.

Funding agency : Indian Council of Agricultural Research (ICAR), Government of India

Objectives (Field based units) :

- i. To assess the production performance of goat breeds in farmers' flocks under village management system and improve the germplasm through selection.
- ii. To evaluate the socio-economic status of goat breeders and the economics of goat production in farmers' flocks.
- iii. To disseminate the pro-poor goat-based technologies under field conditions and assess their impact on goat production.

Research highlights :

1. An Osmanabadi goat field unit was established at NARI in April 2009 under the AICRP on Goat Improvement. The first centre under this unit was established in Satara district in Bibi and Wadgaon villages, 25 km from Phaltan town. The second centre will be established in Osmanabad district during 2010-11.
2. A socio-economic survey of all goat keepers in both the villages was carried out.
3. Three hundred and two breedable does are being recorded in Bibi and Wadgaon villages. Each adult goat is individually identified with a plastic ear tag. Detailed periodic recording has been done of their body measurements, body weight, milk yield, reproduction, mortality and morbidity, cost incurred for goat rearing and income earned.
4. Three hundred and ninety kids were born from 1 September 2009 to 1 April 2010. The average litter size was 1.5. The average kidding interval of 40 Osmanabadi does was calculated and was found to be 230 days.
5. The major breeding season of Osmanabadi does is from May to July, followed by August to October and a small number of does breed from October to March also.

6. Thirty eight per cent of the male kids and 22% of the female kids aged 3 to 6 months were sold.
7. The least squares mean three-month weight of single-born kids (35 records) was 12.5 ± 0.5 kg and that of twin-born kids (77 records) was 11.1 ± 0.4 kg. Thus does giving birth to twin kids were found to wean almost 80% more kid weight (without supplementary feeding to does or kids) than does giving birth to single kids. Three-month weights of Osmanabadi kids in this study were higher than the ~ 7 kg given in the report of the Network Project on Osmanabadi Goats, MPKV, Rahuri.
8. The test-day milk yield of Osmanabadi goats was found to be 883 g up to 30 days from kidding (27 records), 850 g from 31 to 60 days after kidding (23 records), 715 g from 60 to 90 days after kidding (62 records), 618 g from 91 to 120 days after kidding (38 records) and 576 g from 121 to 154 days after kidding (49 records). The mean milk yield of Osmanabadi goats over a lactation of approximately 150 days would thus be close to 100 litres as opposed to the earlier estimate of 65 to 70 litres in the Osmanabadi Network Project report.
9. There was large variation in kid weight and milk yield, indicating a potential for selection.
10. The least squares mean weight of empty does was 33.2 kg (174 records), of kidded does was 32.7 kg (61 records) and pregnant does was 38.5 kg (38 records).
11. Mortality among kids younger than 3 months was 8.4% and among kids aged 3 to 6 months, it was 4.8%. The mortality was 6% among kids aged 6 to 12 months and 3.7% among adults. The vaccinations against enterotoxaemia, haemorrhagic septicaemia and PPR, deworming and spraying against ectoparasites carried out by NARI played a role in keeping mortality low.
12. NARI has disseminated five Osmanabadi breeding bucks in Bibi and Wadgaon villages since there is a severe shortage. The goat keepers of these villages appreciate having these bucks available for breeding their goats.
13. The average sale price of Osmanabadi kids obtained by their owners was more than Rs.100 per kg live weight. It is thus estimated that the goat keeper's minimum gross income per doe per year was Rs.1700.

Principal investigator : Dr. Chanda Nimbkar

Project staff : Mr. Kanhaiya Chavan, Dr. Kiran Unaune, Mr. Popat Shinde, Mr. Swanand Joshi

Project 3. Assessment of green and dry matter yield and quality of NARI Nirbeeja (KX2 or *Leucaena leucocephala* x *Leucaena pallida*) planted on a farm bund and grown without direct irrigation after the first 9 months and without fertilizer for use as fodder for ruminants.

Funding agency : Self-funded. The donation of 3 m X 150 m shade net for our new greenhouse for “NARI nirbeeja” subabhal grafting by Mr. Pramod Gujar, Pune is gratefully acknowledged.

Duration : August 2008 to August 2011

Objectives :

1. To assess yield of NARI *Nirbeeja* trees harvested at intervals of 12 weeks.
2. To compare the difference in yield of leaves at cutting heights of 1 m and 0.5 m
3. To assess the nutritive value of NARI Nirbeeja leaves – crude protein, acid detergent fibre (ADF) and neutral detergent fibre (NDF) after every harvest.

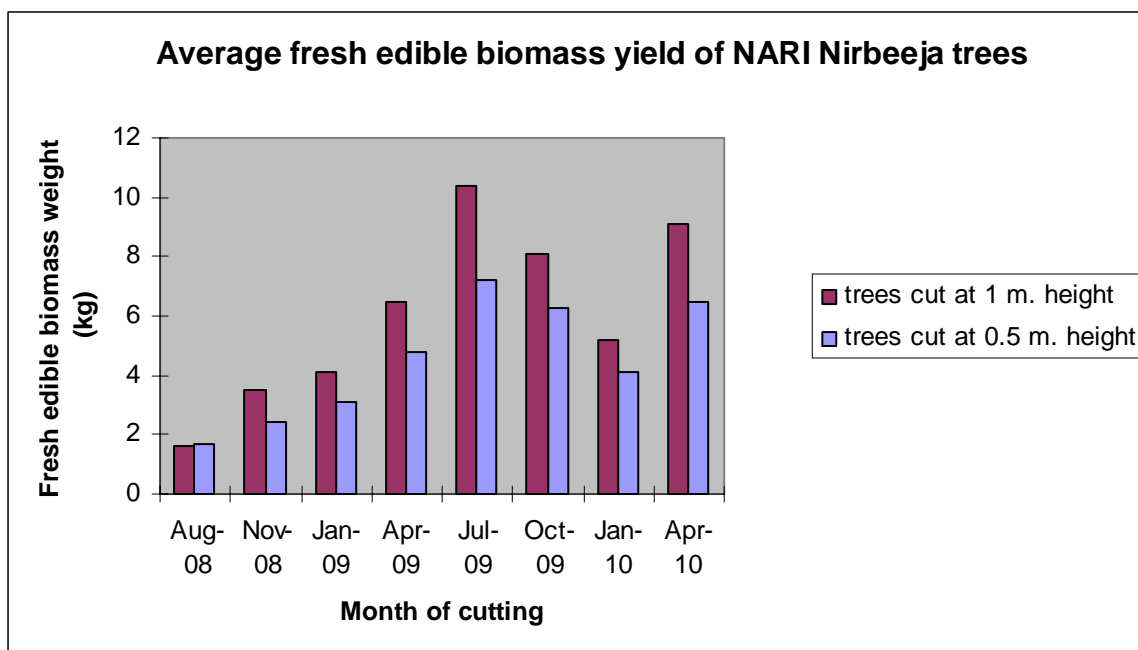
It was intended to formulate recommendations for farmers on the optimum time of harvesting NARI Nirbeeja and the height at which to harvest the trees.

The trees were transplanted on 20 February 2008. They were cut for the first time on 8 August 2008 and at 12-week intervals thereafter. Five trees were always cut at a height of 1 metre from the ground and five trees were cut at 0.5 metres. The yield from eight cuts is considered here, the last cutting having been done on 9 April 2010.

Research Highlights :

1. The trees cut at 1.0 metre height consistently yielded about 30% higher edible biomass (leaves and stems) than trees cut at 0.5 metre height. The average total fresh edible biomass yield per tree from eight cuts over 1.66 years was 47.4 kg for trees cut at 1 metre height as compared to 36.4 kg per tree for trees cut at 0.5 metre. The trees cut at 1 metre height also yielded about 21% more wet wood (26.9 kg as against 22.3 kg). We can therefore recommend unequivocally that NARI Nirbeeja trees planted for fodder should be cut at a 1.0 metre height.

After the first 9 months, the trees were not irrigated. They probably got water when the adjacent plots were irrigated. The yield will increase if they are irrigated regularly.



2. NARI Nirbeeja trees grow slower in the winter than in the summer and rainy season; especially if they are also water-stressed. No damage by psyllid was, however, observed. The trees suffered severe water stress between October and January as no crop was planted in the plots on either side of the bund with the trees. The edible biomass yield measured in January 2010 was lower because of that.
3. The dry matter percentage of pooled stems and leaves of NARI Nirbeeja was 38.5%, the crude protein percentage on a dry matter basis was 27.5%, the ADF was 14.4% and the NDF was 34%. Nirbeeja or KX2 *Leucaena* is thus a good source of digestible protein for ruminants. Farmers who don't have irrigation can also plant these trees as they will survive a drought although the yield will reduce.

Project advisers : B. V. Nimbkar, Dr. N. Nimbkar, Dr. A. Siddiqui, Dr. Pradip Ghalsasi and Dr. C. Nimbkar.

Project staff : P. P. Ghalsasi, Ashok Magar and Rohini Jadhav

Project 4. Research in veterinary parasitology with special reference to sheep and goats : During the year we monitored NARI's flocks and those of shepherds and goat keepers participating in NARI's projects for gastro-intestinal worm burdens under natural infection.

Research findings :

1. We again found Garole sheep to be naturally more worm-resistant than Deccani or crossbred sheep comprising of Deccani, Bannur and/or Awassi proportions grazing with them. Only a few of the Garole sheep (one ram, two ewes and five lambs out of about 45 animals) at Wadjal farm required anthelmintic treatment compared to the crossbred sheep which required mass-drenching treatment once and individual drenching (for those sheep with a high faecal egg count of >1000 eggs per gram of

faeces) four times in the year. Garole sheep typically had low or zero faecal worm egg count (FEC).

2. At Dhuldeo farm and Lundy farm, Rajale, anthelmintic treatment of all animals was carried out three times in the year and individual drenching once in the year. Lambed ewes at Rajale showed peri-parturient relaxation of immunity. Lambing had started from 18 April 2009 and ewes were screened for FEC on 12 May 2009. Seventy nine per cent of sampled ewes had FEC >1000 epg. All ewes were treated with the anthelmintic Albendazole which was found to be 96% effective.
3. The crossbred lambs born in May 2009 at Lundy farm and weaned in August 2009 were tested for FEC in Sept. 2009. 85% of the lambs were found to be positive for FEC. One of the reasons for the infection was weaning stress. Out of 204 lambs 16% had zero FEC, 34% had FEC in the range 100-500 epg, 17% had FEC in the range 600-1000 epg, 28% had FEC range 1000-5000 epg and 5% had FEC in the range 5000-9000 epg.

This means only 5% lambs showed acute infection mainly of the gastro-intestinal nematode *Haemonchus contortus*. Lambs have low immunity to worms because of lack of earlier exposure to worms. These lambs were mass-drenched with long acting anthelmintic Closantel.

Larval cultures of faeces of all animals on all farms showed mixed infection of larval species with predominance of *Haemonchus contortus* followed by *Trichostrongylus* spp.

4. In village Bibi faecal samples of 103 goats belonging to 32 goat owners were collected and measured for FEC. The FEC average was 1137 epg with a range of 0-12000 epg. These goats were drenched with Ivermectin which was found fully effective. In another village Bhadali 58 adult sheep and lambs were sampled for FEC. Adult average FEC was 975 epg and FEC range was 100 to 3200. These were drenched with Albendazole. Effectiveness of the drug could not be checked.
5. This year for the first time we used oral Ivermectin anthelmintic which we found to be fully effective when we tested the post-drench faecal samples. We first used it in October 2009 @ dose of 0.2mg/kg body weight.
6. At Lundy farm, a nutrition trial was conducted where lambing ewes were divided into three groups and were given 200, 300 and 400 g maize per day. The parasite load was found to be similar in all three groups.

Project 5. Evaluation of yield, nutritive value and profitability of some commonly used and some new fodder species with a view to using them as fodder for ruminants

Duration : August 2008 to August 2010

Objectives :

- To compare yield and protein content of some perennially irrigated commonly grown and novel grass and legume species.

Species included in the trial :

Commonly grown species:

Non-leguminous

1. *Dichanthium caricosum* = Marwel

Legumes

2. *Medicago sativa* = Lucerne
3. *Desmanthus virgatus* = Dasharath
4. *Sesbania sesban* = Shewri

Novel species (Non-leguminous)

1. *Brachiaria hybrid* = Mulato II

Novel species (Leguminous)

1. *Leucaena leucocephala* x *Leucaena pallida* = NARI Nirbeeja (KX2)

Most of the seeds germinated within a week and the vegetative material sprouted within two weeks. For NARI Nirbeeja, K8 *Leucaena* seeds were planted at the same time as the other species and NARI Nirbeeja buds were patch /wedge-grafted on to these plants after two months. No chemical or organic fertilizer was used during the trial. All species were consumed readily by sheep and goats. Livestock reared by small farmers usually have a shortage of protein in their nutrition. Therefore protein content of the above species is an important criterion for their evaluation.

The plot where the fodder species were planted had poor drainage. There was, therefore, considerable and prolonged water-logging after irrigation and heavy rainfall which might have led to the spread of fungus on *Sesbania*, *Lucerne* and *Desmanthus*. The *Desmanthus* was completely destroyed in the perennially irrigated plots.

It can be seen from the Table below that of the quick-establishing grasses and legumes, Marwel gave the highest dry matter yield followed by Mulato while the dry matter yield of *Sesbania* and *Lucerne* was less than half of that of Marwel or Mulato. Mulato had a growth setback due to excess water and then due to cold weather and short day length. Therefore the next two cuttings of Mulato after July 2009 could be done only in November 2009 and May 2010. Despite this, Mulato gave the highest protein yield

followed by Sesbania and then by Marwel and Lucerne. The yield of Lucerne was affected by a severe fungus attack.

NARI Nirbeeja or KX2 Leucaena, however, had twice the dry matter yield of Marwel and it far surpassed the protein yield of all grasses and legumes. Therefore, farmers should plant Marwel along with NARI Nirbeeja so that they get some fodder during the first year and from the second year onwards, they can remove the Marwel. NARI Nirbeeja is not attacked by psyllid, withstands water-logging and will yield fodder with a high protein content which is relished by goats, sheep and cattle, for many years. Doing the grafting and caring for the graft and ensuring its survival are the only tedious operations involved in growing of NARI Nirbeeja.

Table: Comparison of fodder species planted in August 2008 under a perennial irrigation regime

Fodder plant	Date of planting	Days to first harvest	Date of last harvest	Total No. of cuttings	Total fresh yield (kg) in 4 sq. m. (average of 3 replicates)	Dry matter (%)	Total dry matter yield (kg)	Protein %	Total protein yield (kg)
Brachiaria (Mulato)	28 Jul '08	124	31 May 10	6	101.6	29.5	30.0	18	5.4
Dichanthium (Marwel)	29 Jul '08	55	31 May 10	14	113.5	31.2	35.4	8	2.8
Sesbania (Shewri)	29 Jul '08	55	4 Jun 10	8	52.9	25.3	13.4	27	3.6
Lucerne (Methighas)	8 Aug '08	200	4 Jun 10	14	45.0	29.8	13.4	17	2.3
Leucaena (KX2) NARI Nirbeeja	27 Sep '08 (date of grafting)	295	8 Jun 10	5	202.3 (average of 2 replicates)	35.3	71.4	28	19.6

I. PUBLICATIONS **(In Alphabetical Order)**

Refereed publications :

1. Nimbkar, C. 2010. Sustainable intensification of sheep rearing on the Deccan plateau in India. A case study of the use of biotechnologies in developing countries. In “Synthesis: Current Status and Options for Livestock Biotechnologies in Developing Countries”. Document prepared for the FAO International Technical Conference on ‘Agricultural biotechnologies in developing countries: Options and opportunities in crops, forestry, livestock, fisheries and agro-industry to face the challenges of food insecurity and climate change’ (ABDC-10). Guadalajara, Mexico, 1-4 March 2010. It is available from [this site](#).

Non-refereed publications :

1. Aggarwal J., Kataria, R. S., Ghalsasi, P., Nimbkar, C., Joshi, B. K. and Mishra, B. P. 2009. Poster: Expression analysis of fecundity related genes in *FecB* carrier Garole ewes by semi-quantitative and real-time PCR. Presented at the Xth Annual Conference of the Indian Society of Animal Genetics held on 27-28 November 2009 at Madras Veterinary College, Chennai, India.
2. Nimbkar C. 2009. Meeting Report. Genetic improvement to increase sheep meat production and profitability of sheep rearing. *Current Science*. Vol. 96 (12) :1566-1567.
3. Nimbkar C., Ghalsasi P. M. and Nimbkar B. V. 2010. Development and dissemination of the NARI Suwarna strain of Deccani Sheep. In: Proceedings of the Seminar on Review of Livestock Policy 2006, Maharashtra State held at YASHADA, Pune. Animal Husbandry Department, Maharashtra State and Maharashtra Livestock Development Board, Akola. 22-23 January 2010. pp. 108-116.
4. Nimbkar C., Ghalsasi P. M. and Nimbkar B. V. 2010. Development and Dissemination of the NARI Suwarna Strain of Deccani Sheep: Genetic Improvement of Production Performance while Maintaining Adaptability. In : Compendium ‘Climate Change and Stress Management: Sheep and Goat Production’ of the National Seminar on Stress Management in Small Ruminant production and product processing organized by ISSGPU at Jaipur, Rajasthan. 29-31 January 2010. pp. 397-406.
5. Nimbkar, N. Final Report of Ad-hoc project on Development of photo-themosensitive sweet-stalk sorghum variety and hybrid having attributes desired by ethanol industry. Submitted to Indian Council of Agricultural Research (ICAR), New Delhi. July 2009. 165 pp.
6. Rajvanshi, A. K. Ethanol lanterns for rural areas. Final project report to Department of Science and Technology (DST), Government of India, New Delhi. April 2009. 65 pp.
7. Rajvanshi, A. K. Life, desire, happiness and sustainability. www.boloji.com/perspective/331.htm, April 12, 2009.

8. Rajvanshi, A. K. Ethanol lantern cum stove for rural areas. <http://www.nariphaltan.org/lanstove.pdf>, June 2009.
9. Rajvanshi, A. K., "Invention of lanstove", PITECH (Pan IIT Tech Review), Issue 6, October 2009.
10. Rajvanshi, A. K. "Nature Conservation + Spirituality = Sustainability". Sustainability Tomorrow. 5(1) : 17-21 (January-March 2010), Published by CII Center of Excellence, New Delhi.
11. Singh, V. Annual Progress Report of All India Coordinated Research Project on Oilseeds (Safflower). Submitted to Directorate of Oilseeds Research (DOR), Hyderabad. June 2009. 115 pp.
12. Singh, V. Annual Progress Report of Frontline Demonstrations in Safflower. Submitted to Directorate of Oilseeds Research (DOR), Hyderabad. June 2009. 74 pp.
13. Unaune, K. P., Pawar, M. L., Jaulkar, A. D., Chavan, K. M., Magar A. H., and Nimbkar, C. 2010. Abstract. Nutritional Stress due to drought conditions does not appear to affect the reproductive performance of Osmanabadi goats in Western Maharashtra state. In: Souvenir and Compendium of the National Seminar on Stress Management in Small Ruminant Production and Product Processing. ISSGPU. Jaipur, Rajasthan. 29-31 January, 2010. p. 86.

Popular articles in Marathi

1. Nimbkar, B. V. 2010. A Canadian farmer' experience: Genetic pollution and farmers' rights. (eka Canadian shetkaryacha anubhav: janukiya pradushan ani shetkaryanche hakka.) (republished) Baliraja magazine. April 2010. pp. 72-73.
2. Nimbkar, C. 2009. Me, a researcher, a development worker. (mee sanshodhak mee vikasak). In Chitralekha magazine, Diwali special issue. pp. 56-60.
3. Nimbkar, C., Chavan, K.M. and Magar, A.H. 2010. Stallfed or partly stallfed rearing of 'NARI Suwarna' sheep: A supplementary occupation to crop farming to increase income and obtain organic manure. ('NARI Suwarna' sankarit mendhyanche bandista / ardhabandista mendhipalan: shetkaryanna adhik utpannasathi wa sendriya khatasathi jod dhanda). Baliraja magazine. March 2010. pp. 40-43.
4. Nimbkar, N. 2009. Need for zero tillage agriculture. (garaj shoonya mashagat shetichi). Agro News. 15-21 April. pp. 2-3.
5. Nimbkar, N. 2010. Leaf-meal : A nutritious feed for animals (janawaranche paushtik khadya : leaf meal). Krishi Panan Mitra. March 2010. p. 41.
6. Ranaware, A. 2009. Methods for control of safflower diseases (kardaivareel roganchya niyantranache upay). Agrowon. 26 December 2009. pp. 6-7.

Marathi booklet published by NARI

1. Marathi booklet on 'NARI Nirbeeja' subabhul grafting (janawaranchya paushtik charyasathi chikata pratibandhak – navin sankarit subabhul 'NARI Nirbeeja'). May 2009. Nimbkar Agricultural Research Institute, Animal Husbandry Division. p. 12.

II. CONFERENCES/SEMINARS/MEETINGS/WORKSHOPS **ATTENDED BY STAFF AND LECTURES GIVEN** **(In Chronological Order)**

1. Dr. Chanda Nimbkar attended the 'Brainstorming workshop on Strategy for Conservation of Farm Animal Genetic Resources' Organized jointly by the Trust for Advancement of Agricultural Sciences, New Delhi and Birsa Agricultural University, Ranchi at Birsa Agricultural University on 10-12 April 2009. She participated in the panel discussion 'The way forward' at the workshop. This workshop was held to formulate a National Action Plan for India under the Global Plan of Action for the Conservation of Animal Genetic Resources ratified by most countries in the world including India. A "Ranchi Declaration" was released at the end of the workshop.
2. Ms. Bharati Pawar attended an agro exhibition 'Ananas 2009' at Sawarde, Dist. Ratnagiri organized by Konkan Agro Producer Co. Ltd. and Shivam Parivar Agrotech, Mumbai on 2 May 2009. She delivered a lecture on 'Improved goat and sheep rearing'. One male each of Boer, Damascus cross and Awassi breeds were displayed in the exhibition. There was good response from the local people.
3. Dr. Chanda Nimbkar gave a presentation on 'Improving family income and nutrition through sheep and goat development in rural India' at the E.T. And Vam York International Seminar Program held on 22 May 2009 at College of Agriculture, Auburn University, Auburn, USA.
4. Dr. A. K. Rajvanshi gave the Dr. B. D. Tilak Memorial lecture at National Chemical Laboratory (NCL), Pune, 22 May 2009. The talk was entitled "[Energy R&D for Rural Development](#)". This is one of the prestigious annual lectures organized by NCL in the memory of Dr. B. D. Tilak – a former Director of NCL.
5. Dr. A. K. Rajvanshi gave a lecture entitled "Lanstove development for rural households" at the Globe Award ceremony in Stockholm, Sweden on 4 June, 2009. During this visit HRH Crown Princess Victoria gave the gobel award to Dr. Rajvanshi. The award ceremony is on [YouTube](#). Dr. Rajvanshi was also interviewed on the Swedish Radio.
6. Dr. Chanda Nimbkar and Mr. B. V. Nimbkar attended the get-together organized on the occasion of 39th Anniversary of the Agricultural Development Trust Baramati, at Shardanagar, Baramati on 22 June 2009.
7. Dr. A. K. Rajvanshi attended the Jamnalal Bajaj Award Selection Committee Meeting on 1 July 2009. This meeting was for selection of the candidate for 2009 Application of Science and Technology for Rural Development Award.

8. Dr. Chanda Nimbkar attended the seventh meeting of the Institute Management Committee of the Project Directorate on FMD at Orissa University of Agriculture and Technology, Bhubaneswar, Orissa on 5 July 2009 as a member of the committee.
9. A speech by Dr. P.M. Ghalsasi on 'Goat nutrition' (shelyancha ahar) was broadcasted by Satara Akashwani radio station on 13 July 2009.
10. Dr. Vrijendra Singh and Dr. Anaytullah Siddique attended the Annual group meeting of AICSIP rabi sorghum workers held at CRC, Solapur on 24 July 2009.
11. A speech by Dr. Chanda Nimbkar on 'Genetic improvement of goats and sheep for increasing their productivity' (shelya mendhyanmadhil utpanna vadhishathi anuvanshik sudharna') was broadcasted by Satara Akashwani radio station on 27 July 2009.
12. Dr. Vrijendra Singh, Mr. M. B. Deshpande and Mr. A. M. Ranaware attended the Annual Rabi Oilseeds Research Workers' Group Meeting held at Orissa University of Agriculture and Technology (QUAT), Bhubaneshwar on 3-5 August, 2009.
13. Dr. A. K. Rajvanshi attended the State Advisory Committee Meetings of Maharashtra Electricity Regulatory Commission (MERC) on 30 August 2009, 30 December 2009 and 26 March 2010.
14. Dr. A. K. Rajvanshi gave an invited lecture entitled "Innovations for Rural Areas", to around 90 undergraduate students of Aeronautical, Mechanical and Chemical Engineering of IIT Bombay on 12 September 2009.
15. Dr. A. K. Rajvanshi gave a Keynote speech at International Seminar on Sustainable Development for Rural India, organized by Invertis Institute of Management Studies, Bareilly on 10 October, 2009. The speech was entitled "Making Rural Areas Energy Self Sufficient".
16. Dr. A. K. Rajvanshi gave a keynote lecture on "Renewable Energy for Rural Development" at National Seminar entitled Commercialization of Renewable Energy Technology (CRET-2009), Organized by D. Y. Patil University, Kolhapur on 21 October 2009. He was guest of honour at the seminar.
17. Dr. A. K. Rajvanshi attended the Jannalal Bajaj Awards Ceremony on 6 November 2009 in Mumbai. As a member of the awards selection committee he was invited to this ceremony.
18. Dr. A. K. Rajvanshi gave a Keynote speech "Rural Innovations for Sustainable Development" at National Symposium on Technologies for Development of Rural India held at Bhabha Atomic Research Center (BARC), Mumbai on 26 November 2009.
19. Mr. B. V. Nimbkar and Dr. N. Nimbkar attended the inaugural program of Shrimant Shivajiraje Horticulture and Agricultural College building of Phaltan Education Society, Phaltan and the workshop organized for farmers on 26 December 2009. The Union Agriculture Minister Hon. Shri Sharad Pawar inaugurated the building.
20. Dr. Chanda Nimbkar, Dr. P. M. Ghalsasi, Dr. M. L. Pawar, Dr. Kiran Unaune, Dr. Ashwini Jaulkar and Shri K.M. Chavan attended the 10th Scientists' Meet of All India Coordinated Research Project (AICRP) on goat improvement on 8-9 January 2010 at Mahatma Phule Krishi Vidyapeeth, Rahuri. Dr. Chanda Nimbkar presented the progress

report of the Osmanabadi Goat Field Unit at NARI under the AICRP (ICAR) on Goat Improvement. Dr. Ghalsasi showed participants the frozen buck semen pellets that the team had taken to Rahuri with them.

21. Ms. Bharati Pawar attended the CPCSEA National Conference 2010 organized by The Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Environment and Forests, Animal Welfare Division, New Delhi held at India Habitat Centre, New Delhi on 15 January 2010.
22. Dr. A. K. Rajvanshi gave a talk entitled “Center for Sustainable Development at NARI” to the Cummins Foundation Board, Cummins India Ltd. Kothrud, Pune on 21 January, 2010.
23. Dr. Chanda Nimbkar and Mr. B. V. Nimbkar attended a seminar on Review of Livestock Policy 2006, Maharashtra State on 22-23 January 2010 at YASHADA, Pune organized by Animal Husbandry Department, Maharashtra State and Maharashtra Livestock Development Board, Akola. Dr. Chanda Nimbkar made a presentation on ‘Development and dissemination of the NARI Suwarna Strain of Deccani Sheep’.
24. Mr. K. M. Chavan attended two meetings of the Agricultural Technology Management Agency (ATMA) on 16 January and 2 February 2010 organized at Taluka Krishi Adhikari Karyalaya, Phaltan.
25. Dr. A. K. Rajvanshi gave an invited talk “How corporate world can help in rural development” at National Seminar “Mera gaon mera desh” (My village my nation), organized by L. N. Welingkar Institute of Management Development and Research, Mumbai on 4 February 2010.
26. Dr. Chanda Nimbkar attended the First meeting of the reconstituted Central Advisory Committee for the Development of Sheep, Goats and Rabbits of Ministry of Agriculture, Government of India on 5 February 2010.
27. Shri B. V. Nimbkar attended the first meeting of the State Level Sanctioning and Monitoring Committee (SLMC) of Maharashtra established for the Implementation of the Central Sector Scheme ‘Integrated Development of Small Ruminants and Rabbits’ of Ministry of Agriculture, Dept of Animal Husbandry, Dairying and Fisheries, Govt. of India as a non-government member on 25 February 2010.
28. Dr. Nandini Nimbkar gave a guest lecture to the students of the Institute of Management, Malegaon Bk on 27 February 2010. The lecture was entitled “Management for sustainable agriculture”.
29. Dr. A. K. Rajvanshi attended a project evaluation meeting (via video conferencing) of NCIIA, a US-based organization to decide on NCIIA awards. These awards of US \$ 50,000 each (ten are given each year) are given to outstanding US universities for innovative projects. Most of the prestigious universities like MIT, UC Berkeley, Stanford University etc. participate in this competition. Dr. Rajvanshi is a member of the 5-person committee to select the awardees.

30. Dr. Vrijendra Singh and Dr. Anaytullah Siddique attended the 40th annual sorghum research workers' group meeting held at Tamil Nadu Agricultural University, Coimbatore from 27 February to 1 March 2010.
31. Dr. Chanda Nimbkar attended the Technical Conference on 'Agricultural Biotechnologies in Developing Countries: Options and opportunities in crops, forestry, livestock, fisheries and agro-industry to face the challenges of food insecurity and climate change'. The conference was organized by the Food and Agriculture Organization (FAO) of the United Nations at Guadalajara, Mexico on 1- 4 March 2010. She presented a paper 'Sustainable intensification of sheep rearing on the Deccan plateau in India. Case study of the use of biotechnologies in developing countries'.
32. Dr. Chanda Nimbkar and Dr. P. M. Ghalsasi attended the 2nd Meeting of the Task Force on Animal Biotechnology-1 of Ministry of Science and Technology, Department of Biotechnology (DBT), Government of India held on 22-23 March 2010 at Maharashtra Animal and Fishery Sciences University, Nagpur. Dr. Chanda Nimbkar gave a presentation on the progress of the ongoing project funded by DBT titled 'Increasing profitability of sheep production by genetic improvement using the *FecB* (Booroola) mutation and improved management'.
33. Shri K. M. Chavan delivered a lecture on 'Goat and Sheep rearing - a profitable business for farmers' at the training program organized jointly by the Maharashtra State Agriculture Department, Jat and Agricultural Technology Management Agency (ATMA), Sangli. Shri Sachin Kakade accompanied him. This lecture was given at two places in Sangli district; at Jat on 25 March and at Kavathemahakal on 26 March 2010 under instructions from Mr. Ajit Ghorpade, former State Minister for Irrigation, Maharashtra.
34. Dr. A. K. Rajvanshi gave an invited talk entitled "Road to prosperous India goes through rural areas" at Observer Research Foundation (ORF), Mumbai on 27 March 2010. The talk was organized by Shri. Sudheendra Kulkarni, Chairman of ORF and advisor to former Prime Minister Shri. Atal Behari Bajpayee. Guest of honor at the function was Shri. Vinay Kore- former minister of Renewable Energy, Government of Maharashtra. The complete lecture has been uploaded by ORF on [YouTube](#).
35. Dr. Chanda Nimbkar, as a member of the Governing Body of ICAR attended the meetings of Indian Council of Agricultural Research (ICAR) at New Delhi during the year.

III. TRAINING AND EXTENSION ACTIVITIES

Training

1. Mr. Nilesh Subhash Pujari and Mr. Ganesh Genba Kharade-students of Malojiraje Agricultural School and Junior College, Phaltan were given one months' on-the-job training from April 9 to May 8, 2009 in reading weather station instruments and other field activities underway at NARI.
2. A demonstration on 'intrauterine silver nitrate treatment in ewes' was organized at AHD for Dr. H.S. Birade and his two colleagues from Department of Gynecology of Krantisingh Nana Patil College of Veterinary Science (KNPCVS), Shirval, Tal. Khandala and representatives of Rajen Biomedical Pvt. Ltd., Mumbai, on 17 June 2009. This was organized under a collaborative scheme of Rajen Biomedicals with KNPCVS 'Acute Safety Evaluation Study of Novel Uterine Chemical Ablation Technique in a Sheep Model'. AHD was involved as a technical adviser in this scheme.
3. Three M.Sc. (Statistics) students, Ms. Monica Pisal, Mr. Dhiraj Dhumal and Mr. Ganesh Matkar from Department of Statistics, School of Mathematical Sciences of North Maharashtra University, Jalgaon worked at AHD from 7-25 December 2009. The students did some statistical analysis of the data on the fodder species trial conducted at AHD's Wadjal farm and data on Osmanabadi goats (under the AICRP Osmanabadi goat field unit at NARI). Their thesis is entitled "A statistical study of body measurements of Osmanabadi and Gaoran goats and some related fodder species".
4. Two M.Sc. (Statistics) students Mr. Pramod Dhanaji Jagdale and Ms. Surashri Jayant Hebalkar, from Department of Statistics, School of Mathematical Sciences of North Maharashtra University, Jalgaon worked at NARI from 7-25 December 2009. They did some statistical analysis of data collected at NARI for their thesis entitled "Analysis of some factors affecting weather and pooled analysis of oilseed soybean (kharif)".
5. Shri. Raghunath Pandit Bharude, from Jalgaon was trained in goat management and artificial insemination in goats at the AHD's farms on 8-14 January 2010.
6. Ms. Prajakta Jadhav, a post graduate student from Department of Animal Genetics and Breeding, Veterinary College, Anand Agricultural University, Anand, Gujarat was given blood samples of two *FecB* gene carrier (homozygous and heterozygous) and one non carrier sheep at AHD on 25 January 2010. She needed the samples to use as positive controls in the PCR reactions to screen local Gujarat sheep breeds for the presence of the *FecB* mutation.
7. Mr. Mohan Galande, a student of Department of Botany, Bhavan's College, Andheri (West), Mumbai affiliated to Mumbai University has been carrying out the work towards his Ph.D. thesis entitled "The cytogenetically and biometrical analysis of different *C. tinctorius* L. (Safflower) genotypes with reference to their yield and its components" during the last year at NARI.

Extension

1. The shepherds' club 'Birdev Shetkari Mendhpal Mandal' established at Bhadali with the support of NARI was inaugurated at the hands of Shri B.S. Parhad, Sub-Divisional Officer, Phaltan on 31 August 2009. Delegates present at the function were Shri. Nitin Phulsundar, Taluka Agricultural Officer, Phaltan, Shri R.T. Dhamal, Branch Manager, Agricultural Division, State Bank of India, Phaltan and Shri B.V. Nimbkar, Dr. Pradip Ghalsasi, Shri K. M. Chavan from NARI.
2. Twentyfive frontline demonstrations were organized in safflower. In them seed yield increase to the tune of 85% was recorded under irrigated conditions when NARI-38 was planted rather than the local variety. Under rainfed conditions the seed yield increase was to the tune of 70% for the hybrid NARI-H-15 over the local variety. Timely adoption of plant protection measures resulted in seed yield increase of 60% under irrigated and 80% under rainfed conditions. Thinning to maintain optimum plant population gave 54% seed yield increase under irrigated conditions over unthinned fields.
3. On 29 January and 13 March 2010 field days were organized at Wathar (Nimbalkar) in Phaltan taluka and Deulgaon Rasal in Baramati taluka respectively. A total of about 150 farmers attended these field days and took information about the improved varieties and hybrids released of safflower by NARI and their cultivation practices.

Dissemination of animals

The following FecB carrier breeding rams and ewes were supplied during the year.

- One homozygous (BB) ram supplied to Shri Vikramsingh Jadhavrao, Village Nanded, Dist. Pune on 19 September 2009.
- Three homozygous (BB) and one heterozygous (B+) rams supplied to Shri S.H. Nasser Mowjee of Five Star Sheep Breeding Farm, Bengaluru on 12 January 2010.
- Ninety four heterozygous (B+) ewes supplied to 12 smallholder sheep owners who are members of the 'Birdev Shetkari Mendhpal Mandal' in Bhadali village in Phaltan taluka on 13 January 2010. They were given loans of Rs.50,000 each by the State Bank of India, Agricultural Development Branch, Phaltan, to purchase the sheep.
- Two homozygous (BB) rams supplied to Krishi Vigyan Kendra, Namakkal, Tamil Nadu on 15 February 2010. The KVK intends to use these rams for on-farm testing under their project "Evaluation of crossing of Mecheri ewes with NARI Suwarna rams to increase twinning percentage in the flock". One ram will be maintained at the KVK Mecheri Sheep demo unit and the other will be supplied to a sheep rearing commodity interest group (CIG) at Mallasamuthram in Namakkal district, Tamil Nadu.
- Twenty nine heterozygous (B+) ewes supplied to Kengeri Star Ranch, Kengeri, Bengaluru on 17 March 2010.

Dissemination of seed and other products

During the financial year about 22 kg dried safflower flowers were test-marketed as herbal health tea. Also 380 kg sweet sorghum syrup Madhura was test-marketed during the year. Two hundred kg seed of Madhura sweet sorghum hybrid was sent for testing to Mauritius and 50 kg to Kenya. About 80 kg 'Madhura' seed was distributed to various companies and farmers in India. More than 200 kg seed of safflower varieties (NARI-38, NARI-6), hybrids (NARI-NH-1, NARI-H-15) and their parents was disseminated during the year.

Volunteers :

The following interns came to the Institute during last year.

Sr. No.	Country	Name	Duration (months)	Place	Purpose	Date of arrival
1.	The Netherlands	Mariette McCampbell	4	University of Groningen	Work on lanstove	13/2/2009
2.	The Netherlands	Maarten Smit	2	Twente University	-do-	5/6/2009
3.	India	Harsh Tilak	1.5	Mumbai University	Sustainable Center lighting design	12/8/2009
4.	U.K.	Dr. Christopher Reeve	2	Sussex University	Design of Sustainable Center website	2/11/2009
5.	India	Amit Bhojane Vikram Kadam	1	Indian Institute of Technology (IIT), Kharagpur	Lanstove drawings (autocad) and design	2/12/2009
6.	Germany	Regina Pavlovic	3	University of Konstanz	Lanstove + PV module of Centre for Sustainable Development	6/1/2010
7.	Australia	Rachel Trigger	1	Corinda, Australia	Computer database program development for AHD	16/1/2010
8.	U.S.A.	Matthew DeAmico	2	Portland, Oregon	Design of cooling system of Center for Sustainable Development	8/3/2010

IV. TRAINING RECEIVED BY NARI STAFF

1. Dr. Anaytullah Siddique obtained training at ILRI campus, Patancheru (Andhra Pradesh) from 20-23 April 2009 regarding analysis of fibre components in sweet sorghum stalk in the laboratory of Dr. M. Blummel.
2. Shri. Navnath Patange participated in the 'Connect IT' capacity building workshop on 6-9 January 2010 at Sangli organized by the NASSCOM Foundation, Mumbai. He got hands-on training on the use of computer office applications.
3. Ms. Sonali Saste obtained training in the technique of genomic DNA isolation from whole blood samples of sheep at National Bureau of Animal Genetic Resources (NBAGR), Karnal, Haryana from 21 January to 2 February 2010.
4. Ms. Sonali Saste participated in the training course on 'Molecular methods and bioinformatics for diagnostics' held at the Department of Animal Biotechnology, College of Veterinary Science, Hisar, Haryana on 3-24 February 2010.
5. AHD organized a training course in machine shearing on 6-17 February 2010 for five sheep owners of Bhadali village in Phaltan taluka and seven farm supervisors of AHD. The course was organized with assistance from Dr. B. S. Rajpurohit, Director Incharge, Central Sheep Breeding Farm (CSBF) of the Ministry of Agriculture, Government of India at Hisar, Haryana. CSBF deputed two trainers Mr. Puran Chand and Mr. Jagdish Chandra for the training course. They brought one Lister shearing machine from Hisar to use during the training course. This training will help sheep owners to shear their own sheep and they will also earn income by shearing sheep belonging to other owners.
6. A workshop was organized for the staff of AHD, conducted by Dr. T. A. Kadarbhai, Head, Krishi Vigyan Kendra on 'Communication skills' on 19 February 2010. Ten staff members participated in the program.

V. VISITORS TO THE INSTITUTE

1. Dr. T. A. Kadarbhai, Head, Krishi Vigyan Kendra, Shardanagar, Baramati visited AHD on 13 April 2009 to discuss about the implementation of AICRP project on Osmanabadi goat field unit at NARI. She showed a film on Krishi Vigyan Kendra.
2. Dr. B. K. Joshi, Director, National Bureau of Animal Genetic Resources, Karnal, Haryana, and two scientists from his institute, Dr. B. P. Mishra, Principal Scientist and Dr. R.S. Kataria, Senior Scientist, visited AHD on 26 to 28 April 2009. This visit was under the collaborative project being carried out jointly by NARI-AHD and NBAGR. They took back with them for RNA extraction and further analysis, ewe ovary samples collected laparoscopically by NARI's Dr. P. M. Ghalsasi.
3. Mr. Matiur Rehman and Ms. Poonam Chaurasia of Television Programme Company of New Delhi filmed the different activities of NARI and interviewed Dr. Rajvanshi on 11 May 2009. A half hour documentary has been made on NARI's activities by them.

4. Ms. Rosalie Abe, a student from the Faculty of Agriculture and Animal Husbandry, University of Switzerland visited AHD on 29 May 2009 to get information on different sheep breeds reared at AHD and new breeds developed by AHD.
5. Mr. Philip Larocco-former President of E&Co, USA his daughter Katherine LaRocco and her friend Rose Azrak visited from 29 May to 1 June 2009 and held discussions regarding the Center for Sustainable Development.
6. Members of the 'Advisory Committee on Animal Husbandry and Dairy Sector' of the Planning Commission, Govt. of India, Dr. G. Thulasi, Director of Extension Education, Tamilnadu Animal Science and Veterinary University, Chennai, and Dr. Chandrashekhar Sahukar, Deputy Advisor (AH), Planning Commission, GOI visited AHD on 8 June 2009. Dr. Chanda Nimbkar gave them a presentation on research and development activities of AHD. They were shown Boer goats and FecB gene carrier rams at AHD's Wadjal farm.
7. Mr. Patrick Guimbeau and his two associates from Mauritius visited NARI to discuss about sweet sorghum cultivation on 17 June 2009.
8. Dr. Scott Gibson, Dr. Sadananda and Mr. N. M. Kolekar of Advanta India Ltd. visited on 29 June 2009 regarding possible collaboration on sweet sorghum.
9. Dr. Dhimant Panchal, MIT School of Design, Pune along with his colleagues visited AHD on 8 July 2009 to give advice on preparing educational posters.
10. Dr. Subhash Shinde from the Sandia National Laboratory, U.S.A. and Prakash Takawale from Saswad visited on 9 July 2009 to see the energy work at NARI.
11. Ms. Farah Alibay from the Massachusetts Institute of Technology (MIT), USA visited on 14 July 2009 to discuss sweet sorghum and oil seeds as fuel crops.
12. Dr. Peter J. Isaac from Bangalore visited NARI on 27 July 2009 for information on sweet sorghum.
13. NDTV team came to NARI on 30 July 2009 to shoot the renewable energy activities of the Institute. A six minute clip was broadcast by NDTV on 5 December 2009 during "Shell Dialogues" program.
14. Mr. Satish Chilekar an international water expert visited with four other experts in various fields on 5 August 2009 to advise on various aspects of the building of the Center for Sustainable Development.
15. Ba Bocar Samba Diam, Montreal, S. Balaji Mani, MIT Boston and Sam Ridgenway, UCLA-all students visited on 17 August 2009 to discuss problems of sustainable transportation in India.
16. Smt. Meena Pawar, Mr. Rajan Dhamdhare, Smt. Ushaprabha Page, Ms. Girija Page Smt. Kalpana Salunkhe (Gram Gaurav Pratishthan, Khalad), Dr. Aarati Parkhi (Advisor, Pune hi-tech infra engg. pvt. ltd., Hadapsar) visited on 25 August 2009 for discussions on sweet sorghum and rural electrification.

17. Shri. Chandrakant Khade, Conservator of Forests, Nashik along with two colleagues visited AHD on 7 September 2009 to get information about varieties of fodder available with AHD.
18. Shri. Pravin Rohidas Mane, a student from College of Agriculture, Dapoli visited AHD on 10 September 2009 to get detailed information and references for Mulato fodder for his project on studying nutritive value of Mulato feed for goats.
19. Dr. P. S. Prabhakar (CRC, Solapur), Dr. Umakanth (DSR, Hyderabad) and Dr. Biradar (Vijapur) visited on 18 September 2009 to monitor the sweet sorghum coordinated trials at NARI.
20. Shri. Vasanttrao Mankumare, Chairman, Education, Satara Zilla Parishad visited on 24 October 2009 to see improved goats and sheep at AHD.
21. Dr. Vivek N. Khandait, Research Associate, Dept of Veterinary and A.H. Extension, Veterinary College, Bidar under the Karnataka Veterinary and Animal Science University visited AHD on 26 October 2009 to take delivery of ten NARI Nirbeeja grafts purchased by them. He learnt the grafting technique with a view to training farmers to produce grafts as an income-earning activity. At that time he took information about the activities of AHD.
22. On 9 November 2009 Priyanka Desai and Ganesh Naik of IBN Lokmat News visited to shoot NARI energy activities for the popular morning program "Salaam Maharashtra". This program was broadcasted on 11 November 2009 for one hour on the IBN Lokmat channel.
23. Mr. Rajesh Aggarwal, IAS, Principal Secretary, Animal Husbandry, Dairying and Fisheries Department, Government of Maharashtra visited AHD on 14 November 2009. He was accompanied by Mr. D. S. Zagade, Commissioner, Animal Husbandry, Maharashtra and Dr. P. L. Kakade, Managing Director, Punyashlok Ahilyadevi Maharashtra Sheep and Goat Corporation Ltd. Pune. They visited Institute's Lundy Farm at Rajale village to see NARI Suwarna ewes and breeding rams. He was given a demonstration of semen collection of rams and artificial insemination of ewes. In the afternoon we showed him the semen freezing, molecular biology and parasitology laboratories. Dr. Chanda Nimbkar gave a presentation on 'Achievements and activities of the Animal Husbandry Division, NARI'.
24. Dr. Nada K. Nadarajah, Senior Research Fellow, Department of Animal Sciences, Auburn University, USA visited on 19-24 November 2009. His visit was to discuss the preparation and submission of a collaborative research proposal between both institutions. He also introduced the AHD's staff members to the goat data recording software prepared by him using MS Excel. During his stay he visited AHD's farms at Rajale, Dhuldeo and Wadjal villages and saw NARI Suwarna ewes and Boer goats. He also visited Nimbkar Seeds Pvt. Ltd.'s goat farm. On 20 November 2009 he visited NARI H.O. and held discussions with Dr. Rajvanshi and Dr. Nimbkar.

25. On 7 December 2009 Dr. R. G. Bankar of Excel Bioresources Pvt. Ltd. along with his two colleagues from Gujarat visited for discussions regarding dissemination of sweet sorghum syrup-making technology.
26. Mr. Nitin Kathuria and Mr. Vaibhav Kulkarni of Marico Industries Ltd. visited on 10 December 2009 to discuss dissemination of NARI safflower varieties and hybrids in their contract farming programme and evaluation trial at NARI.
27. Dr. R. D. Prasad, Sr. Scientist (Plant Pathology), DOR, Hyderabad, Mr. L. Hanumantharaya (Jr. Entomologist), AICRPO, UAS, Agri. Res. Stn. Annigeri and Mr. G. Samangouda (Jr. Agronomist), AICRPO, UAS, Agri. Res. Stn. Annigeri visited on 3 January 2010 for monitoring of the coordinated trials.
28. Mr. Yagya Raj Adhikari and his two colleagues from Nepal visited on 5 January 2010.
29. Smt. Nirmala Pandit and her colleagues from Nav Maharashtra Community Foundation visited AHD on 15 January 2010 and discussed possibilities of implementing an improved milk goat production project through their foundation. She also showed interest in NARI Suwarna sheep.
30. Shri. P. S. Thakur, retired Agriculture Officer, Sangli District and Shri. Ajitrao Ghorpade, former State Minister for Irrigation, Maharashtra visited on 16 January 2010 to discuss about the possibility of starting genetic improvement programmes of sheep and goats in Sangli District based on the NARI pattern.
31. Dr. D. M. Hegde, Project Director, DOR, Hyderabad and Dr. S. V. Khadtare, Jr. Agronomist, AICRPO, Solapur visited the safflower programme on 31 January 2010.
32. Ms. Jean Blackwell, CEO of Cummins Foundation, USA with her two American and three Indian colleagues including Col. P. K. Masand of Cummins (India) Ltd. visited NARI on 3 March 2010 for discussions on CSR. They showed their satisfaction about the building of the Center for Sustainable Development.
33. Mr. Sunil Pathak, an Industrialist from Pune visited on 8 March 2010 for discussions on ethanol stove manufacture.
34. Mr. Jayant Pawar and Mr. Jonas Pawar visited NARI on 20 March 2010 to see the projects being carried out.
35. Mr. Siddharth Barthakur of Ashoka Foundation, New Delhi visited on 22 March 2010 to get information about NARI work.

Visits by groups during the year

1. Under the Agri Clinics and Agri Business Training program conducted by MITCON, Pune, 20 agricultural graduates visited AHD on 22 April 2009.
2. Mr. Amol Jadhav-field work coordinator in Yashwantrao Chavan School of Social Work in Satara visited with 66 students on 23 July 2009.

3. Shri. J. B. Kopkar, Retd. DYSP, Bagalkot, Karnataka along with eight persons visited on 3 August 2009.
4. M. K Ghadge, General Manager, NABARD, Chandigarh visited on 14 August 2009 together with 7 agricultural entrepreneurs to obtain information on all aspects of goat and sheep rearing.
5. A group of 50 students from the Tata Institute of Social Sciences (TISS) came to NARI on 5 September 2009. All these students were employees of UNICEF and were interested in discussing the issues of rural development.
6. Students of College of Agriculture, Baramati visited for collection of weather data on 20 June, 2 July, 18 August, 17 September and 3 November 2009.
7. Forty farmers from Lanja Taluka, Dist. Ratnagiri visited through the Krishi Vigyan Kendra, Lanja.
8. A group of 22 including 6 staff members, 2 women paravets, and 14 women leaders of Saheli Samitis in Dausa District in Rajasthan visited AHD on 13 November 2009 to get information on improved breeds of goat and sheep. They showed interest in Boer goats.
9. Mr. D. B. Dharaskar, Field Manager, IFFCO, brought a group of 25 farmers from Sangli having irrigated land on 25 November 2009 to show them improved goats and sheep at AHD.
10. Taluka Agricultural Officer, Dapoli, Dist. Ratnagiri organized a study tour of 40 farmers to AHD on 17 December 2009.
11. Vidya Mandir and Manoj Chavan along with students of Kamala Nimbkar Bal Bhavan visited NARI on 6 January 2010 learn about the water testing protocol.
12. Fourteen B.A. (Economics) students of Mudhoji College, Phaltan visited NARI on 8 January 2010.
13. Fifty six students of Padmabhushan Dr. Sukhatme Institute of Agriculture, Phaltan visited NARI H.O. and AHD on 12 January 2010.
14. Taluka Agricultural Officer, Palus, Dist. Sangli organized a study tour of 20 farmers to NARI H.O. and AHD on 20 January 2010.
15. Dr. Prashant Kambale, Livestock Development Officer and Dist. Animal Husbandry Officer, Zilla Parishad, Thane brought a group of 25 farmers to AHD on 27 January 2010.
16. Dr. B. Mohan, Programme Co-ordinator, Krishi Vigyan Kendra of Veterinary College and Research Institute, Namakkal, Tamil Nadu organized a visit of 55 farmers from Tamil Nadu to AHD on 15 February 2010. Ms. Bharati Pawar gave them a presentation on the research and development activities of the Institute. Dr. Ghalsasi showed them around the farm. They purchased two homozygous FecB carrier rams for breeding.

17. District Agricultural Officer of Nanded brought a group of 40 farmers to AHD on 12 March 2010 to show activities of the AHD.
18. Two teachers with 34 students of Sou. Venutai Chavan Girl's Junior College, Phaltan visited on 12 March 2010 to get information about NARI.
19. Taluka Agricultural Officer of Bhokar, Dist. Nanded visited along with 39 farmers on 29 March 2010.

VI. VISITS BY STAFF

1. Dr. Chanda Nimbkar, Dr. P. M. Ghalsasi and Dr. P. Bankar visited the office of the NGO 'Paryay' at village Kalamb in Osmanabad district on 28 June 2009 to see Osmanabadi goats and activities of the institute.
2. Dr. Chanda Nimbkar, Dr. P. M. Ghalsasi and Dr. P. Bankar visited the Sangamneri goat field unit at Mahatma Phule Krishi Vidyapeeth on 29 June 2009. Dr. S. Mandakmale gave them information about the unit.
3. Dr. Chanda Nimbkar visited and had discussions with Dr. L. Mohan, Director, Animal Husbandry, Andhra Pradesh at his office in Hyderabad on 4 July 2009 about the introduction of FecB carrier sheep in Andhra Pradesh.
4. Dr. Chanda Nimbkar visited the Ganjam Goat Field Unit of Orissa University of Agriculture and Technology on 5 July 2009. Dr. S.K. Dash, Associate Professor, Incharge of the Unit gave her information about the unit.
5. Dr. Chanda Nimbkar visited the Central Sheep Breeding Farm of the Ministry of Agriculture, Government of India, at Hisar, Haryana on 27-29 August 2009. She also visited the National Research Centre on Equines of the ICAR, at Hisar where Dr. R.K. Singh, the Director, showed her around. She also visited Dr. Gaya Prasad in the Animal Biotechnology Department of the College of Veterinary Science, CCS Haryana Agriculture University in Hisar, Haryana.
6. Dr. V. Singh was of member of the monitoring constituted by Directorate of Oilseeds Research to visit and evaluate safflower programme at various centers. He visited Latur, Somnathpur, Naigaon, Parbhani, Akola, Achalpur, Buldhana and Badnapur from 14-23 November, 2009.

VII. HONOURS RECEIVED BY STAFF

1. Dr. Chanda Nimbkar was nominated by the Indian Society for Sheep and Goat Production and Utilization (ISSGPU), Avikanagar for the ISSGPU fellowship-2010.
2. Dr. A. K. Rajvanshi was invited to give the Dr. B. D. Tilak memorial lecture at the National Chemical Laboratory (NCL), Pune on 22 May 2009. This is one of the prestigious annual lectures organized by NCL in the memory of Dr. B. D. Tilak-a

former director of NCL. It was also of greater significance as Dr. B. D. Tilak was one of the well-wishers of NARI and served on its scientific advisory committee.

3. In tough competition with five prominent nominees NARI won the Globe Sustainability Research Award 2009. The goal of this award presented for the third time this year is to discover and encourage researchers and research institutes prominent in sustainability research. It was judged on several criteria including originality, practicality, and contributions to humanity through economic gains, social development and environmental protection. The award was presented to NARI's director Anil Rajvanshi by H.R.H. Crown Princess Victoria of Sweden, at a [ceremony in the Winter Garden](#) of Grand Hotel in Stockholm on 3 June 2009.

VIII. OTHER ACTIVITIES

1. On 21 August 2009 an article on Lanstove work of NARI by Amy Lieberman, UN correspondent was published in Media Global "Voice of the Global South". Media Global is an independent international organization based in UN. The article was entitled "Research institute links ancient Indian thought with new technology" (<http://www.mediaglobal.org/article/2009-08-21/research-institute-links-ancient-indian-thought-with-new-technology>).
2. A very detailed review of Dr. Anil K. Rajvanshi's book "1970s America – An Indian Students Journey" appeared [in Current Science](#), Vol. 97, No. 8, 25 October 2009. This review was written by Prof. Navin Singhi Professor of Mathematics Tata Institute of Fundamental Research, Mumbai.
3. A-one hour program on renewable energy entitled "Shell Dialogues" was broadcast on NDTV on 5 December 2009. Dr. Rajvanshi was one of the five panelists, the others being Ms. Sunita Narain, Director, CSE, New Delhi, Mr. Deepak Gupta, Secretary, MNRE, GOI, Mr. Harish Hande, President, SELCO, Bangalore and Mr. Ratnesh Yadav of Husk Power Systems Company in Bihar. A six-minute clip on NARI was also shown during the program. The program is available on [YouTube](#).
4. The Institute started providing grafted plants of the psyllid-resistant hybrid of *Leucaena* (Subabhul) 'NARI Nirbeeja' from April 2008. 'NARI Nirbeeja' subabhul is a source of high protein supplementary feed for animals. The number of plants supplied during the year was 332 out of which 34 plants were given free. These grafts were taken by private farmers and institutions.
5. The Veterinary College, Bidar, Karnataka purchased 10 'NARI Nirbeeja' subabhul grafts and sent their representative to learn the technique of grafting so as to impart it to the farmers there.
6. Two meetings of the Institute's Animal Ethics Committee of NARI were held at the AHD's office on 18 April 2009 and 26 March 2010 respectively.

IX. STAFF APPOINTMENTS TO PRESTIGIOUS POSITIONS

1. Dr. Chanda Nimbkar was appointed as a non-official member on the reconstituted Central Advisory Committee for the Development of Sheep, Goats and Rabbits for the period of four years with effect from 4 January 2010 by the Ministry of Agriculture, Govt. of India.
2. Shri B.V. Nimbkar was appointed as a non-Government member of the State Level Sanctioning and Monitoring Committee (SLMC) of Maharashtra on 29 December 2009. This committee has been established for the Implementation of Central Sector Scheme 'Integrated Development of Small Ruminants and Rabbits' of Ministry of Agriculture, Dept of Animal Husbandry, Dairying and Fisheries, Govt. of India.

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August 2010