

ANNUAL RESEARCH REPORT 2015-2016



**Nimbkar Agricultural Research Institute,
Lonand Road, PHALTAN-415523,
Maharashtra**

September 2016

Nimbkar Agricultural Research Institute (NARI), Phaltan

ANNUAL RESEARCH REPORT 2015-16

Report of the President



It is my pleasure to present the Annual Report of the Nimbkar Agricultural Research Institute for the year 2015-16. The report highlights the research achievements at NARI.

I acknowledge the support and cooperation of all the staff and the members of the governing council. I also acknowledge our various stakeholders. Their advice and cooperation has always been helpful in our endeavour. Their confidence in us will certainly provide us the energy to work hard to lead in the field of research and development in the future.

Some of the highlights of the year were as follows :

1. Dr. Anil Rajvanshi gave an invited talk entitled “How to become good engineers” to the freshmen engineers at the College of Engineering of University of Florida. It was very well received.
2. Dr. Chanda Nimbkar was nominated to the Board of Trustees of the International Livestock Research Institute (ILRI), a CGIAR institute based in Nairobi, Kenya. She is the only Indian member of the board at present.
3. A promising safflower variety developed by NARI called NARI-96 giving high oil yield performed well in Advanced Varietal Trial 2 in Rabi 2015-16 and will be proposed for identification in the 2016 annual workshop.
4. NARI is a partner in the new project entitled ‘Developing high oleic safflower genotypes through functional genomics’ funded by ICAR under National Agricultural Science Fund. This project is being carried out in collaboration with the National Chemical Laboratory and Bharati Vidyapeeth University.

5. With the support of the Government of Karnataka, the 'Nari Suwarna' strain is becoming more popular than the Deccani or Bellary sheep in some districts of Karnataka due to its 70% higher twinning proportion and better profitability.

This year also Mr. B. V. Nimbkar gave a generous donation of Rs. 5 lakhs for the grassland development and nectariferous eucalyptus projects. I would like to thank Mr. Nimbkar as well as others who have so kindly given donations to further our various research activities.

Dr. N. Nimbkar
President

September 7, 2016

Safflower

1. All India Coordinated Research Project (AICRP) on Oilseeds (Safflower)

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

Scientists : V. Singh, Ph.D., Dr. R. R. Jadhav, Ph.D., G. E. Atre, M.Sc., R. V. Kale, M.Sc.

Technical staff : M. B. Deshpande, M.Sc., P. R. Salgude, M.Sc., P. T. Karande, M.Sc., S. V. Choudhari, B.Sc., J. U. Bangar, M.Sc., A. D. Kokane, M.Sc.

NARI is one of the centers of All India Coordinated Research Project (AICRP) for safflower (*Carthamus tinctorius*) research under limited irrigation since 1980. The programme is monitored by the Indian Institute of Oilseeds Research (IIOR), Hyderabad which is the central agency under ICAR for planning, coordinating and monitoring of AICRP on sunflower, safflower and castor. 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*) along with development of suitable agro-production and crop protection technologies for growing safflower under limited irrigation. Recently development of short duration and single-headed safflower have received high priority owing to their future importance in the changing scenario of safflower production.

Research Highlights : The major highlights of safflower programme implemented during 2015-16 are furnished below :

BREEDING

(I) **Development of 60-day safflower :** In order to develop 60-day safflower for regions with shallow soils, the short duration safflower maturing in 90 days was crossed with single-headed safflower. The F₁s were sown in summer 2015 and were found to be producing normal branching and maturing in 115-120 days. The F₁s were selfed and harvested separately. The F₂s of short duration, single-headed safflower were sown in rabi 2015-16. The F₂ population segregated into single-headed plants flowering in 45 days and maturing in 60 days after sowing and normal duration, branched and unbranched plants, in addition to short duration branched plants. The seeds of single-headed plants maturing in 60 days were threshed separately in order to examine their yield potential. Safflower maturing in 60 days

has been developed for the first time and is expected to be highly suitable for production under shallow soil conditions and also during off-season in conventional and non-conventional areas of safflower production. 60-day safflower will also be highly suitable for intercropping in different geometries thus increasing area and production of safflower. This ideotype will also facilitate mechanized harvesting of flowers and seeds which is likely to make its production more economical compared to normal branched safflower maturing in 120-130 days.

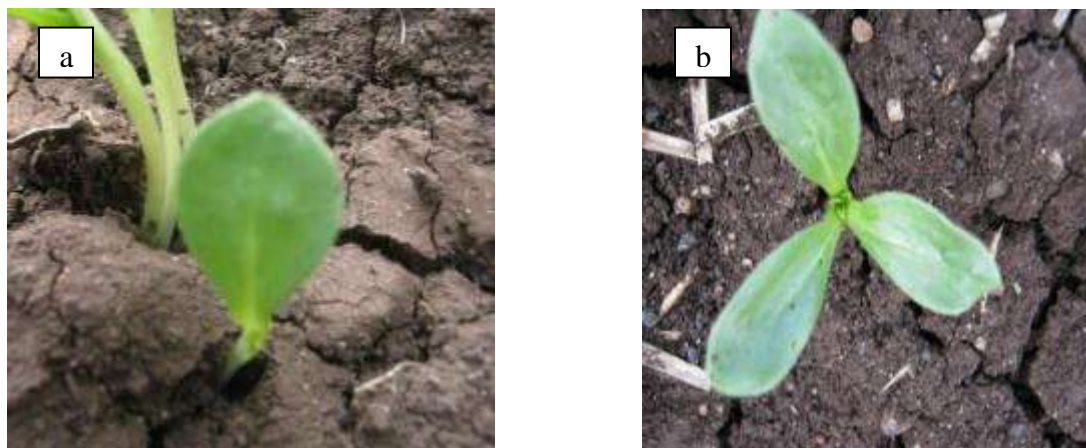


60-Day safflower (R) with regular safflower (L)

- (II) **Evaluation of genotypes producing only primary branches in comparison with regular safflower** : Variability among the genotypes producing only primary branches was assessed by comparing them to the normal genotypes producing primary, secondary and tertiary branches as the checks. The data of normal genotypes used as checks was collected for number of seeds/capitulum based on main, primary, secondary and tertiary branches. In A-1 the main capitulum produced 22 seeds, primary branches-based capitula 20, secondary branches-based capitula 12 and tertiary branches-based capitula only 5.5 seeds. Similarly PBNS-12 gave 24 seeds in main capitulum, 17 in primary branches-based capitula, 12 in secondary branches-based capitula and 7 in tertiary branches based capitula. Thus both the genotypes showed drastic reduction in number of seeds per capitulum as the order of

capitula increased from primary to tertiary branches. The seed yield of capitula based on main, primary, secondary and tertiary branches in a plant were also compared in the two checks which showed that for A-1 seed yield of the main capitulum was higher by 16.66% than the primary, 123% than the secondary and 444.44% than the tertiary branches-based capitula. In case of PBNS-12 similar results were recorded. Thus capitula borne on higher order branches showed significant reduction in productivity as compared to capitula borne on main and primary branches. The evaluation of genotypes with only primary branches revealed the average number of capitula/plant to be 5.8 with average number of 32.5 seeds/capitulum. The average weight of seed per primary capitulum was recorded to be 1.8 g. The genotypes with primary branches thus produced higher number of seeds and seed yield/capitulum than was produced in the corresponding capitula in normal genotypes. Genotypes with only primary branches, at the present level of productivity in terms of number of seeds and seed yield/capitulum need to be improved to have at least 20 capitula/plant so that they can compete with the regular genotypes having primary, secondary and tertiary order of capitula. Also the genotypes with primary branches need to be evaluated under different environments to assess their potential and suitability to different environments.

(III) **Identification of mono and tricotyledony in safflower** : We report pleiocotyly which includes mono and tricotyledony in safflower. We identified safflower genotype D-150-8-2-3 which had 9.7% plants expressing monocotyledony. Another genotype GMU-3332 was identified to have tricotyledony to the extent of 10.88%. The fitness and relationships of these traits with other traits are being investigated to use them in future breeding programmes. Both the traits may also be suitably used as morphological traits to distinguish different cultivars.



Safflower seedlings showing monocotyledon (a) and tricotyledons (b)

(IV) **Evaluation of safflower as a leafy vegetable** : The study assessed the performance of safflower (an oilseed crop) varieties/genotypes for fresh vegetable yield, nutritional qualities and monetary returns in different seasons. High vegetable yield under summer and monsoon conditions showed the suitability of safflower to two growing situations in which it is conventionally not grown. Nutritional parameters of safflower were comparable to the two most commonly eaten leafy vegetables viz. fenugreek and spinach. The promotion of safflower as a leafy vegetable will provide an additional nutrient source to the consumers and a source of additional remuneration to safflower growers. As far as we know the performance and likely returns from safflower cultivars used as vegetable in three seasons have been studied for the first time.

Fresh vegetable yield (Kg/ha) of safflower, fenugreek and spinach

Particulars		Season		
		Winter (2014-15)	Summer (2015)	Monsoon (2015)
Fresh vegetable yield (Kg/ha)	Safflower	656-4744	427-7767	5175-8331
	Fenugreek*	10000-12900	1800-2100	5000-7000
	Spinach*	11600-14000	8000-9000	9000-12000

* Source : Data provided by local farmers from irrigated fields (single cutting @ 35-40 DAS)

Nutritional parameters of vegetable safflower, fenugreek and spinach grown in summer-2015

Crop	Fat (%)	Protein (%)	Vit C (mg/100 g)	Phenolic compounds (mg/100 g of GAE)
Safflower (Range)	1.15-2.85	21.00-29.75	8.06-18.99	76.00-234.87
Safflower (General mean)	2.01	26.27	12.66	146.12
Fenugreek* (General mean)	1.27	21.83	18.25	218.58
Spinach* (General mean)	1.12	23.84	10.91	99.91

* Source : Purchased from local market. GAE = Gallic Acid Equivalent

- (V) Ten F₄ high oleic populations of the 47 varieties evaluated gave higher seed yield than the respective best checks in two trials.
- (VI) **Evaluation of short duration F₇ selections** : Ninety-nine short duration F₇ selections were evaluated along with short duration and regular duration checks for seed yield in three trials during rabi 2015-16. The results showed that of the 99 entries evaluated 20 entries gave significantly higher seed yield than the short duration check JSI-93.
- (VII) One hundred thirty one advanced generation lines which have stabilized for uniformity and seed yield were screened for seed yield and showed 71 lines giving higher seed yields than the respective best checks.
- (VIII) Out of the 55 CMS and TGMS hybrids evaluated, 14 hybrids gave higher seed yield than the best check NARI-H-23. The maximum seed yield of 3345 Kg/ha was recorded by the hybrid TGMS-H-419. This hybrid also showed the highest heterosis of 48% for seed yield over the TGMS hybrid check NARI-H-23.

(IX) **Development of high seed and oil-yielding safflower cultivar** : A promising safflower variety NARI-96 giving high seed and oil yield was evaluated in Advanced Varietal Trial I during rabi 2014-15. It gave an increase of 19% in oil yield over the best check PBNS-12 under irrigated conditions and 10% increase in oil yield over the check A-1 at National level. NARI-96 contains 33.6% oil in its seeds as compared to 27.1% in the seeds of the check PBNS-12 and 26% in those of A-1. This variety has been evaluated in Advanced Varietal Trial II during 2015-16.

(X) **Coordinated Varietal Trials** :

Center conducted two IVT and one AVHT-I and -II during rabi 2015-16.

(XI) **Seed production of safflower varieties and hybrids** : NARI has produced 750 Kg seed of non-spiny variety NARI-6, 300 Kg seed of NARI-57, 86 Kg seed of NARI-NH-1, 150 Kg seed of male parent of NARI-NH-1 and 16 Kg seed of female parent of NARI-NH-1 during rabi 2015-16.

2. National Agricultural Science Fund (NASF) Project on ‘Developing high oleic safflower genotypes through functional genomics’ :

Funding Agency : Indian Council of Agricultural Research, New Delhi

Participating Institutes :

- (1) CSIR-National Chemical Laboratory, Pune.
- (2) AICRP Safflower, Nimbkar Agricultural Research Institute, Phaltan.
- (3) Bharati Vidyapeeth University, Pune.

Objectives of the Project :

- (1) Developing TILLING population of 10,000 lines from a high linoleic safflower genotype.
- (2) Identifying and characterizing mutants of the CtFAD2-1, CtFAD2-10 and CtFADB genes in the TILLING population.
- (3) Identifying natural variants of CtFAD2-1, CtFAD2-10 and CtFADB genes in safflower germplasm.
- (4) Multi-location evaluation of selected high oleic genotypes for stability of oil and agronomic traits.

Date of commencement of the Project : July 1, 2015

Highlights :

- (1) **Raising Ethyl Methane Sulfonate (EMS)-treated safflower population for identifying high oleic mutants :** Safflower variety PBNS-12 was selected for carrying out mutagenesis with EMS treatments. EMS concentrations of 1, 0.5, 0.2 and 0.1% were used for treating the seeds. Each treatment was sown in 2000 m² area. Each plant of each treatment was harvested and threshed separately to grow M₂ generation. In general, high male sterility was observed in seeds treated with EMS concentrations of 0.5 and 1%. Mutants for different traits like height, number of capitula, leaf shape, size, variegation and structure of plant ideotypes have been identified and maintained separately to examine their inheritance in subsequent generations.
- **Supply of leaf samples for identifying high oleic natural mutants :** Leaf samples of 67 g from different safflower accessions were supplied to NCL, Pune for DNA characterization to identify natural mutants of CtFAD2-1, CtFAD2-10 and CtFADB genes in them.

PLANT PATHOLOGY

1. **Survey of safflower diseases :**

A survey of safflower diseases was conducted in Satara and Sangli districts in rabi 2015-16. In almost all the fields surveyed the *Alternaria* leaf spot incidence was found to be more than that of *Fusarium* wilt. Out of the 50 farmers' fields surveyed, 43 fields were rainfed while seven were irrigated. The fields were surveyed during flowering stage. In most of the sowings of safflower, seeds were mixed with sorghum and chickpea. In Mayni area mixed cropping with sorghum and one sole cropping were observed, while in Renavi safflower was strip-cropped with wheat. Majority of the fields except the frontline demonstrations (FLDs) were sown with local spiny varieties. The *Alternaria* leaf spot grade ranged from 0 to 5 in the irrigated and rainfed crops. Partial wilting was observed in some fields, while the early sown rainfed crop exhibited wilt disease grade ranging from 0 to 3. None of the farmers had applied any fungicidal/ insecticidal sprays except in the FLDs.

2. Confirmation of host resistance against *Fusarium* wilt [Sick plot technique] :

In this trial 42 entries along with susceptible checks Nira and PBNS-12 were screened against *Fusarium* wilt caused by *Fusarium oxysporum* f.sp. *carthami*. Among them, SAF-1205-1 (W), SAF-1205-1 (R) and NARI-P-5 Showed moderately resistant reaction against *Fusarium* wilt. The highest seed yield of 880.56 kg/ha was recorded by the entry NARI-P-5 with disease incidence of 32.60%.

3. Screening of selected elite material against *Alternaria* leaf spot :

The trial comprised of 49 entries, including 16 IVT-I, 16 IVT-II and 15 IH-AVHT entries with two checks, viz. susceptible check (SC) Manjira and tolerant check (TC) HUS-305. It was sown in a randomized block design with two replications to screen the elite lines against *Alternaria* leaf spot. All the entries were found to be susceptible to the disease *Alternaria* leaf spot.

4. Screening of selected elite material against *Fusarium* wilt :

The trial comprised of 49 entries including 16 of IVT-I, 16 of IVT-II and 15 of IH-AVHT along with susceptible checks Nira and PBNS-12. Among these, IH-AVHT-15-14 recorded the lowest wilting of 14.65% and entries IVT-I-15-5, IVT-II-15-13, IH-AVHT-15-7 and IH-AVHT-15-15 recorded wilting percentage < 25%. These have been categorized as tolerant to wilt. However, rest of the entries showed highly susceptible reaction to wilt. The susceptible checks Nira and PBNS-12 exhibited a wilting percentage of 76.16 and 72.93% respectively.

5. Fungicidal management of *Alternaria* leaf spot of safflower :

To evaluate the efficacy of fungicides against *Alternaria* leaf spot of safflower, a trial was sown in a randomized block design with three replications on 21/09/2015. The treatments in the trial consisted of seven fungicides and a control (water spray). The lowest percent disease intensity was recorded in plots treated with Azoxystrobin @ 0.05% (26.26%) followed by Mancozeb @ 0.25% (30.89%) and Propiconazole (30.96%). The highest seed yield (370.37 kg/ha) was recorded by Mancozeb-treated plot. Mancozeb treatment also recorded the maximum gross returns, net returns and benefit cost ratio and was followed by the treatment of application of Propiconazole.

6. **Uniform disease nursery :**

The seven entries along with four checks viz. NARI-38 (TC), A-1 (National Check), NIRA (SC) and HUS-305 (TC) were evaluated against *Fusarium* wilt of safflower. All the test entries including checks were found to be susceptible to *Fusarium* wilt. The plant population was poor in this trial due to low seed quantity.

7. ***Alternaria* leaf spot development in relation to weather parameters :**

The trial comprised of susceptible variety Manjira for evaluation of disease (*Alternaria* leaf spot) development in relation to the weather parameters. The weather parameters, maximum and minimum temperature in the first date of sowing, minimum temperature and maximum relative humidity in the second date of sowing, maximum and minimum temperature and maximum relative humidity in the third date of sowing and minimum temperature and maximum and minimum relative humidity in the fourth date of sowing showed significant effect on disease development at 5% probability. Therefore minimum temperature appears to be the most important weather parameter affecting disease development followed by maximum relative humidity.

8. **Disease incidence in breeding and agronomy experiments :**

During rabi 2015-16, there was a major problem of soil-borne root rot diseases at our research farm. The intensity of *Alternaria* leaf spot was low to moderate in all the trials. In some trials, a moderate incidence of wilt disease caused by *Fusarium oxysporum* f.sp. *carthami* was observed.

9. ***In vitro* efficacy of fungicides on the growth of *Fusarium oxysporum* f. sp. *carthami* :**

Fungicides Carbendazim 0.1%, Propiconazole 0.1%, Carbendazim+Mancozeb 0.2%, Difenconazole 0.05%, Hexaconazole 0.1%, Azoxystrobin 0.05% and Mancozeb 0.25% were tested to determine their relative toxic effect on radial mycelial growth of *Fusarium oxysporum* f.sp. *carthami* by using poison food technique. Results showed significant differences in radial mycelial growth of *Fusarium oxysporum* f.sp. *carthami* on days 3, 5 and 7 in fungicide treatments compared to the untreated control. Carbendazim 0.1% and Carbendazim + Mancozeb 0.2% showed complete suppression of radial mycelial growth *i.e.* 100 per cent growth inhibition of *F. oxysporum* f. sp. *carthami* on days 3, 5 and 7.

10. *In vitro* efficacy of fungicides on the growth of *Alternaria carthami* :

Fungicides Carbendazim 0.1%, Propiconazole 0.1%, Carbendazim+Mancozeb 0.2%, Difenconazole 0.05%, Hexaconazole 0.1%, Azoxystrobin 0.05% and Mancozeb 0.25% were tested to determine the degree of inhibition of radial mycelial growth of *Alternaria carthami* by using poison food technique. Results showed significant differences in radial mycelial growth of *Alternaria carthami* on days 3, 5 and 7 compared to the untreated control. Propiconazole 0.1%, Hexaconazole 0.1% and Mancozeb 0.25% showed complete suppression of radial mycelial growth *i.e.* 100 per cent growth inhibition of *A. carthami* on days 3, 5 and 7.

AGRONOMY

1. Yield maximization in safflower

The yield maximization trial recorded a seed yield of 529 kg/ha, with gross returns of Rs. 14823/ha, net returns of Rs. -8793/ha and benefit cost ratio of 0.63.

2. Comparative productivity and profitability of safflower to other rainfed *rabi* crops/systems

The results of the trial showed that the significantly highest safflower equivalent yield of 3391 kg/ha was recorded for non-spiny safflower hybrid NARI-NH-1. It was followed by sole sorghum (2635 kg/ha) which was on par with sole gram (2615 kg/ha) and sorghum + safflower (2328 kg/ha). The sole gram gave the highest net returns of Rs. 51604/ha and was followed by non-spiny safflower NARI-NH-1 (Rs. 51575/ha) and sole sorghum (Rs 50011/ha). The significantly highest benefit cost ratio was given by sole gram (3.39), which was on par with sole sorghum (3.1). Thus in the present scenario it is marginally more beneficial to plant sole gram than sole non-spiny safflower hybrid NARI-NH-1.

3. Influence of planting time on oil content and oil yield of safflower

The results of the trial showed that differences due to dates of sowing were significant for seed yield and oil content, while those due to varieties were significant for seed yield, oil content and oil yield. The first and second dates of sowing gave the significantly higher oil content than the third date of sowing. Among the varieties tested NARI-57 gave the significantly highest oil content of 36.80% as against 28.76% in NARI-6 and 27.24% in A-1, the latter two being on par with each other at the first date of sowing on 30 September 2015. There were no statistically

significant differences between the oil yields of the three entries tested at the three sowing dates. Therefore, it can be concluded that sowing on 15 October 2015 is the most desirable since it gave the maximum seed yield and oil yield in all the entries.

4 Assessment of suitable plant population for crop diversification

The results of the trial showed that differences due to different spacings were significant for seed yield and 100 seed weight. In general closer spacings between rows i.e. 30 x 20 cm and 45 x 20 cm gave numerically higher seed yields than the wider spacings such as 60 x 20 cm, 75 x 20 cm and 90 x 20 cm. Among the varieties tested NARI-38 recorded significantly higher seed yield than A-1 at all the spacings examined in the trial. Therefore under irrigated conditions for getting higher seed yields safflower variety NARI-38 with a spacing of 30 or 45 cm between rows and 20 cm between plants can be recommended for commercial production.

5 Revised fertilizer recommendation

Two trials were conducted on farmers' fields to revise fertilizer recommendation if necessary, but due to drought condition these trials were vitiated.

Sweet sorghum

All India Coordinated Sorghum Improvement Project (AICSIP)

Funding Agency : Indian Council of Agricultural research (ICAR), New Delhi.

Scientists : Radhika Prabhakaran., Ph.D, Ketaki Kanbargi, M. Tech.

Technical Staff : Mr. C. S. Khore, M.Sc., Ms. U. D. Gaikwad, M.Sc., Mr. S. V. Jadhao, M.Sc.,
Ms. Sheetal Ranade, M.Sc., Ms. A. R. Gholap.

NARI is one of the centers of All India Coordinated Sorghum Improvement Project (AICSIP) for sweet sorghum [*Sorghum bicolor* (L.) Moench] research since 2009. The program is monitored by the Indian Institute of Millets research (IIMR), Hyderabad, which is the central agency under ICAR to work on all aspects of sorghum research and development throughout India. The main objective of the AICSIP centre at NARI is to develop high sugar and biomass-yielding hybrids and cultivars giving high yield of good quality grains through collaborative multi-location testing and facilitate production of genetically pure seeds for the farmers as well as improvement of syrup production from sweet sorghum juice round the year.

Major thrusts of research and development (R & D) under AICSIP at NARI centre :

1. Development of sweet sorghum varieties and hybrids yielding high biomass, sugar and grain.
2. Development of high brix CMS lines.
3. Development of shoot fly-tolerant sweet sorghum restorers and maintainers.
4. Identification of promising lines for syrup production.
5. Quality improvement of syrup and also enhancing its shelf-life.
6. Development of high grain-yielding cultivars for post-rainy (winter) season.

Research highlights :

The investigations carried out during the year under this project are described below:

Kharif (Rainy season) 2015 :

Varietal Development :

1. 98 F₈ progenies were evaluated and 90 of them performed better than the varietal checks CSV-19-SS and CSV-24-SS. Performance of the best entries is given below :

Entry	Biomass (t/ha)	TSI (t/ha)	Brix of juice (%)	Juice yield (t/ha)
F ₈ (DC-126)-17-4-2-4-1	50.91	1.86	18	10.50
F ₈ (DC-126)-17-4-2-4-2	49.13	1.85	19	9.53
CSV-19-SS	35.94	1.02	19	5.26

2. A total of 37 Preliminary Varietal Trial (PVT) lines were evaluated and few of them showed better performance than the check CSV-19-SS for biomass yield and brix % in juice. Performance of the best entries is given below :

Entry	Biomass (t/ha)	TSI (t/ha)	Brix of juice (%)	Juice yield (t/ha)
(D-18)-7-10-2	40.97	1.09	20.0	5.52
(D-91)-35	38.81	1.04	20.0	5.11
(D-118)-75-7	37.40	0.61	19.0	3.13
CSV-19-SS	37.20	1.24	19.0	6.32

3. Evaluation of single plant selections of the promising entry Madhura-3 identified many better performing entries than the checks CSV-19-SS and CSV-24-SS. Performance of the best entries is given below:

Entry	Biomass (t/ha)	TSI (t/ha)	Brix of juice (%)	Juice yield (t/ha)
(Madhura-3)-34-1	40.01	1.38	22	6.31
(Madhura-3)-34-23	40.92	1.15	20	5.76
(Madhura-3)-34-64	44.60	1.85	21	8.78
(Madhura-3)-34-78	42.19	1.38	22.4	6.16
CSV-19-SS	27.57	0.74	20.5	3.74
CSV-24-SS	24.22	0.78	21.5	3.61



Madhura-3
(SPV2268)
Flowering stage



Madhura-3
(SPV2268)
Panicle



Madhura-3
(SPV2268)
Stripped stalks

Fig 1 : Promising variety Madhura-3 (Selection for All India multi-location trials under AICSIP programme)

Hybrid development :

A total of 52 CMS-based hybrids were developed during Rabi 2014-15 and were evaluated during Kharif-2015 for their performance against the national check CSH-22-SS. Performance of the best hybrids is given below :

Entry	Biomass (t/ha)	TSI (t/ha)	Brix of juice (%)	Juice yield (t/ha)
Set I				
NARI-Hybrid-37	39.74	1.19	19	6.24
NARI-Hybrid-10	31.59	0.85	19	4.47
CSH-22-SS	22.11	0.60	17	3.41
Set II				
NARI-Hybrid-38	49.55	2.02	20	10.03
SSRH-290	51.56	2.25	19.7	11.36
SSRH-293	50.15	4.54	18	20.85
CSH-22-SS	28.18	0.90	19.5	4.61

Agronomy :

Two agronomy trials were conducted to identify the appropriate sowing date and plant to plant spacing for the varieties Madhura-2 and Madhura-3 along with the control varieties CSV-19-SS and CSV-24-SS. Significantly highest biomass ($41.81 \text{ T}\cdot\text{ha}^{-1}$) and stripped stalk ($28.07 \text{ T}\cdot\text{ha}^{-1}$) weight were given by Madhura-2. Stripped stalk weight ($26.89 \text{ T}\cdot\text{ha}^{-1}$) of CSV-19-SS was on par with that of Madhura-2. There were no statistically significant differences between the varieties for juice yield and total sugar index (TSI).

There were no statistically significant difference between dates of sowing (25 May, 11 June and 29 June) for biomass and stripped stalk yield, as well as TSI. 11 June sowing date gave significantly highest juice weight ($8.11 \text{ T}\cdot\text{ha}^{-1}$) and was on par with 29 June sowing date ($7.83 \text{ T}\cdot\text{ha}^{-1}$). Madhura-2 gave significantly highest juice weight and TSI and was on par with Madhura-3 for TSI. Both Madhura-2 and Madhura-3 were significantly superior to the controls CSV-19-SS and CSV-24-SS for juice weight and TSI.

AICSIP Trials

Four trials were allotted and successfully conducted at the center, namely,

1. IAVHT Trial :

16 Entries and three checks were evaluated during the Kharif-2015 season. NARI center had contributed two entries namely SPV2268 i.e. NARI-SS-15 (AVT II) and SPV2395 i.e. NARI-SS-16 (IVT).

Most promising entries for important parameters in comparison to checks are given in the table below :

	Biomass (t/ha)	Fresh stalk (t/ha)	Juice (l/ha)	Brix of juice (%)	TSI (t/ha)
RSSH 18	50.38	36.8	8109	16.3	1.3
RSSH 50 (Rahuri)	49.78	36.5	9290	16.1	1.42
NARI-SS-15	44.01	34.4	7414	17.3	1.2
NARI-SS-16	41.71	32.0	8708	16.2	1.53
CSV-19-SS	43.81	34.1	10746	16.1	1.61
CSV-24-SS	43.13	33.5	7442	16.1	1.25
CSH-22-SS	44.80	39.7	6860	16.7	1.36
General mean	42.71	32.3	8036	16.3	1.39
CV%	18.51	18.2	20.82	7.34	22.02
CD 0.05	7.5	6.2	3223	1.4	0.50

NARI-SS-15 and NARI-SS-16 were on par with the other promising entries and the controls in the trial for brix of juice and TSI. NARI-SS-16 was on par with the best control for juice yield, while NARI-SS-15 was on par with the best control for biomass and fresh stalk yields.

2. High biomass trial :

Nine trial entries including CSH-13 and three sweet sorghum checks; CSV-19-SS, CSV-24-SS and CSH-22-SS were evaluated during Kharif-2015.

Promising selections for important parameters in comparison to checks are given in the table below :

	Plant height (cm)	Stem diameter (cm)	Fresh biomass (t/ha)	Dry biomass (t/ha)	Brix of juice (%)
ICSSH 88 (ICRISAT)	322	4.7	77.0	18.8	16.2
RSSH 50 (Rahuri)	322	4.9	64.4	13.3	15.6
CSV-19-SS	317	3.9	69.8	23.1	17.0
CSV-24-SS	256	4.3	69.7	23.4	16.8
CSH-22-SS	279	4.5	72.3	16.1	17.6
General mean	297	3.8	67.0	17.9	16.8
CV%	9.75	8.09	16.2	11.3	9.22
CD (0.05)	30.5	0.47	21.6	3.45	2.15

None of the entries were superior to the best control for juice brix and fresh and dry biomass yield. Entries ICSSH 88 and RSSH 50 were on par with the best control for plant height and stem diameter.

3. Response of pre-release sorghum genotypes to different fertilizer levels under rainfed conditions :

Pre-release sweet sorghum genotypes that were promoted to AVT II were evaluated for their response to fertility (50%, 75% and 100% NPK) in sorghum growing parts of the country. NARI-SS-15 and ICSV-25306 (ICRISAT) were evaluated at Phaltan, Indore and Surat. The check sweet sorghum cultivar was CSV-24-SS. NARI-SS-15 performed better than the check cultivar at Phaltan and Surat, while it underperformed at Indore. There were no significant differences in the mean performance of all three sweet sorghum genotypes. NARI-SS-15 showed an increasing trend in fresh biomass, fresh stalk and grain yield with incremental increase in the level of fertilizer.

4. 1k Phenotyping of Kharif sorghum germplasm for mid-season drought adaptation :

30 promising germplasm lines were evaluated for 22 characters in three replications. Some of the prominent entries included were CSV15, CSV20, SPV462, (M-35)-1, Phule Anuradha, CSV-24-SS etc. The check used was CSV23 which is a dual purpose Kharif variety. Unfortunately, most of the data of Phaltan centre was rejected due to high coefficient of variability. Significant differences were observed among the genotypes for leaf area at flowering, leaf area index at 50%

flowering, total chlorophyll, Relative Water Content at flowering, leaf dry weight at 50% flowering and maturity, stem dry weight at 50% flowering and maturity, panicle dry weight at 50% flowering and maturity, total dry biomass at flowering and maturity, dry stover yield at maturity, 1000 grain weight, grain number per plant, staygreen score at physiological maturity, grain yield and harvest index. Stable staygreen character was observed in genotypes like IS-23579, IS-29187, Indore 12 and SPSSV 30 but they were on par with B 35 (staygreen check). Significantly higher total biomass than the check CSV 23 both at flowering and physiological maturity was observed in genotypes IS 23579, IS 23521, IS 21083, NSSV 261 and CSV-24-SS.

Rabi (Post-rainy season) 2015-16 :

Varietal Development :

1. 27 F₁ crosses were evaluated and four crosses were selected based on high biomass, TSI and grain yield for the subsequent Kharif 2016 evaluation.

Cross code	Biomass (t/ha)	TSI (t/ha)	Brix of juice (%)	Juice yield (t/ha)	Grain (q/ha)
LT-39	41.13	1.39	18	7.74	37.88
LT-49	30.57	0.66	16	4.15	30.65
LT-53	27.29	0.69	19	3.66	27.85
LT-59	36.18	0.86	13	6.82	32.48

2. 36 F₃ selections were evaluated and few of the entries gave an increase in biomass over the better parent Phule Chitra. Performance of the best entries is given below :

Entry	Biomass (t/ha)	TSI (t/ha)	Entry	TSI (t/ha)	Grain (q/ha)
(D-139)-56	45.95	0.60	(D-139)-62	0.56	46.11
(D-139)-65	44.62	0.61	(D-139)-4	0.14	56.97
SSV-84	22.85	0.49	SSV-84	0.49	11.52
Phule Chitra	27.34	0.30	Phule Chitra	0.30	34.65

Hybrid Development :

1. A total of 48 CMS-based hybrids were evaluated in two sets during Rabi 2015-16 for high biomass and sugar components. CMS A lines developed at NARI had been used as a female parent in many of the crosses. Performance of the best hybrids is given below :

Entry	Biomass (t/ha)	TSI (t/ha)	Brix of juice (%)	Juice yield (t/ha)	Entry	Grain (q/ha)
Set I						
NARI-Hybrid-33	54.29	1.07	16.2	6.56	NARI-Hybrid-35	51.07
NARI-Hybrid-9	48.47	1.78	16.5	10.76	NARI-Hybrid-29	51.34
CSH-22-SS	27.12	0.49	14.3	3.49	CSH-22-SS	37.3
Set II						
SSRH-282	47.43	2.08	18.5	11.24	SSRH-280	36.08
NARI-Hybrid-44	44.10	1.51	20.3	7.49	SSRH-292	27.28
CSH-22-SS	17.34	0.37	15.0	2.49	CSH-22-SS	12.58

2. 25 CMS lines developed at NARI were evaluated for various parameters. Promising entries for different yield parameters are given in the table below :

Entry	Biomass (t/ha)	Entry	Juice (t/ha)	Entry	TSI (t/ha)	Entry	Grain (q/ha)
BC-5-1-3-2-1-2B	28.52	BC-5-1-1-1-2-5B	4.49	BC-59-1-2-3-4B	0.81	BC-3-1-2-1-2-1B	45.61
BC-3-1-2-1-2-1B	28.43	BC-59-1-2-3-4B	4.18	BC-5-2-1-3-1-3B	0.75	BC-54-1-1-1-3B	32.62
BC-41-5-3-2-2-2B	31.77	BC-5-1-1-5-1-1B	3.77	BC-5-1-1-5-1-1B	0.72	BC-5-1-1-5-1-2B	25.78

3. A total of 71 land races were evaluated for various yield parameters and the performance of the promising land races is given in the table below. 36 land races with tan character were identified and some of them were NARI-LC-07-16, NARI-LC-07-18, NARI-LC-07-25, NARI-LC-07-38, NARI-LC-07-42 and NARI-LC-07-60. Performance of the best land races is given below :

Entry	Biomass (t/ha)	Entry	Brix of juice (%)	Entry	TSI (t/ha)	Entry	Grain (q/ha)
NARI-LC-07-4	36.47	NARI-LC-07-1	24.2	NARI-LC-07-2	1.44	NARI-LC-07-30	20.34
NARI-LC-07-37	33.77	NARI-LC-07-14	22.4	NARI-LC-07-37	1.26	NARI-LC-07-12	17.14
NARI-LC-07-38	30.85	NARI-LC-07-11	22.2	NARI-LC-07-89	1.07	NARI-LC-07-73	16.18

Seed production : Large scale seed production of Madhura-3 carried out on 2000 m² yielded 500 Kg seed.

AICSIP Trials

Two trials were allotted and successfully conducted at the center, namely,

1. IAVHT-Sweet sorghum :

19 entries were evaluated including three checks (CSV-19-SS, CSV-24-SS, and CSH-22-SS) during Rabi 2015-16. Two varieties developed at NARI (NARI-SS-15 and NARI-SS-16) were

evaluated for AVT III and IVT. Juice brix % of both the varieties (13.6 and 13.5) was on par with that of five other entries and significantly superior to that of the best check CSV-19-SS (12.1).

Outcome of the trial on All India basis :

1. IIMRSSH-2 (IIMR), ICSV-25306 (ICRISAT) and PVKK-902SS (Parbhani) had the highest biomass (43.12, 42.61, 42.57 t/ha).
2. RSS-430 (Rahuri), IIMRSSH-2 (IIMR) and IIMRSSV-1 (IIMR) had the highest juice yield (5497, 5429, 5333 l/ha).
3. Total sugar yield and computed ethanol yield was highest in IIMRSSV-1 (0.61 t/ha; 324 l/ha), RSSV-430 (0.59 t/ha; 316 l/ha) and IIMRSSH-2 (0.59 t/ha; 314 l/ha).

2. IAVHT-Shallow soil-grain sorghum :

In this trial, eight varieties, four hybrids and six checks were evaluated mainly for grain and dry fodder yield.

Outcome of the trial on All India basis :

1. Check CSH 15R (1287 Kg/ha) and RSV-1786 (Rahuri) (1149 Kg/ha) gave the highest grain yield.
2. RSH-1242 (Rahuri) (6858 Kg/ha) and AKSH-700R (Akola) (6642 Kg/ha) gave the highest dry fodder yield.

Production of seeds and syrup during 2015-16

Sr. No.	Sweet Sorghum seed	Quantity (kg)
1	(D-118)-34 (Madhura-3)	500
2	(D-94)-74 (Madhura-2)	250
3	Madhura	211
4	(D-91)-9	60
5	(D-18)-7-10-2	50
6	(D-158)-20	37
7	(D-23)-21-2	30
8	(D-141)-33	30
9	Phule Chitra	27
10	(D-118)-25-3	22
11	(D-18)-7-8-1	14
12	(D-141)-34	13
13	(D-34)-11-1	13
14	(D-158)-81	11
	Total	1268

Sr. No.	Syrup	Quantity (kg)
1	Madhura syrup	826

Other projects

1. **Effect of cutting intervals on yield and nutritive value of *Stylosanthes seabrana*** : An irrigated trial was carried out on Tambmal farm in a randomized complete block design with four replications. The harvest intervals of 30, 45, 60, 75, 90, 105 and 120 days were compared for total fresh and dry herbage yield, plant height, % leaf, total protein weight and % moisture, fat, ash and protein in the herbage. Significantly highest total dry weight was given by two cuts at 90-day and five cuts at 45-day intervals. Though significantly highest average protein, moisture and leaf percentage were obtained for the 30-day cutting interval, the 45-day cutting interval gave the highest total weight of protein on dry weight basis from the five cuts in a year.

2. ***Cenchrus ciliaris* and *Stylosanthes seabrana* for grassland development in semi-arid areas of Maharashtra** : This trial was sown in July 2013 and evaluated in December 2014. In October 2015 plots of each of the four varieties viz. CAZRI-75, Gayndah, Laredo and *Cenchrus* hybrid (?) were divided into five parts and treated with fertilizers containing N:P in a ratio of 0:0, 10:10, 20:20, 0:20 or 20:0 Kg/ha. The trial will be evaluated after monsoon 2016.

3. ***Leucaena* variety ‘Wondergraze’ + buffelgrass (*Cenchrus ciliaris*) pasture establishment** : A one acre plot was sown with ‘Wondergraze’ variety of leucaena and ‘Laredo’ variety of buffelgrass on 13 July 2015. The total cultivation and establishment cost came to about Rs. 25,000/-. Double rows of *Leucaena* were planted at a spacing of 45 cm every 4.5 m. In the area between the double rows of *Leucaena* sowing of *Cenchrus* was carried out. Two male buffalo calves were allowed to graze in this ‘pasture’ every day for 88 days. It was found that a total weight gain of 106 Kg was achieved in 88 days. It was estimated that the two calves consumed about 62 Kg buffelgrass and 1.5 Kg *Leucaena* fresh fodder per Kg weight gain, grazing on about 1400 sq.m. area.

4. ***Stylosanthes seabrana* seed production** : Approximately 1143 Kg seed was produced from two acre area. It was harvested in October-November 2015. The sowing was carried out in April 2015. Seven treatments replicated three times were given as follows : 1) *Gliricidia*

leaves @ 7500 Kg/ha 2) Farmyard manure @ 7500 Kg/ha 3) Phosphorus @ 150 Kg/ha 4) Potassium @ 50 Kg/ha 5) 1 + 3 + 4 6) 2 + 3 + 4 and 7) 3 + 4. Three 2 m² quadrats from each plot were harvested for assessment of biomass weight, plant height and seed yield. Six months after sowing the plant height ranged from 129 to 141 cm, fresh weight from 46 to 61 T/ha and seed yield from 810 to 1175 Kg/ha. There were no statistically significant differences between the different fertilizer treatments.

5. **Nectariferous *Eucalyptus* introduction from Israel** : Mr. B. V. Nimbkar through his reading learned about the plantations in the Negev desert in Israel of trees of different *Eucalyptus* species. He then initiated correspondence with the office-holders of Keren Kayemeth LeIsrael Jewish National Fund (KKL-JNF). They were kind enough to send us seeds of eight different species of nectariferous *Eucalyptus* through NBPGR, New Delhi. These are being propagated at present. NARI also sponsored the visit of Mr. Madhav Gogate, IFS (Retd.) to Israel to see the work of KKL-JNF on 25-26 November 2015. We hope to carry out large scale propagation of these *Eucalyptus* spp. with the help of J. K. Papers Ltd. and plant them in adivasi areas of Gujarat and Maharashtra so that an improvement in the honey flow from the forests is achieved.

Renewable Energy

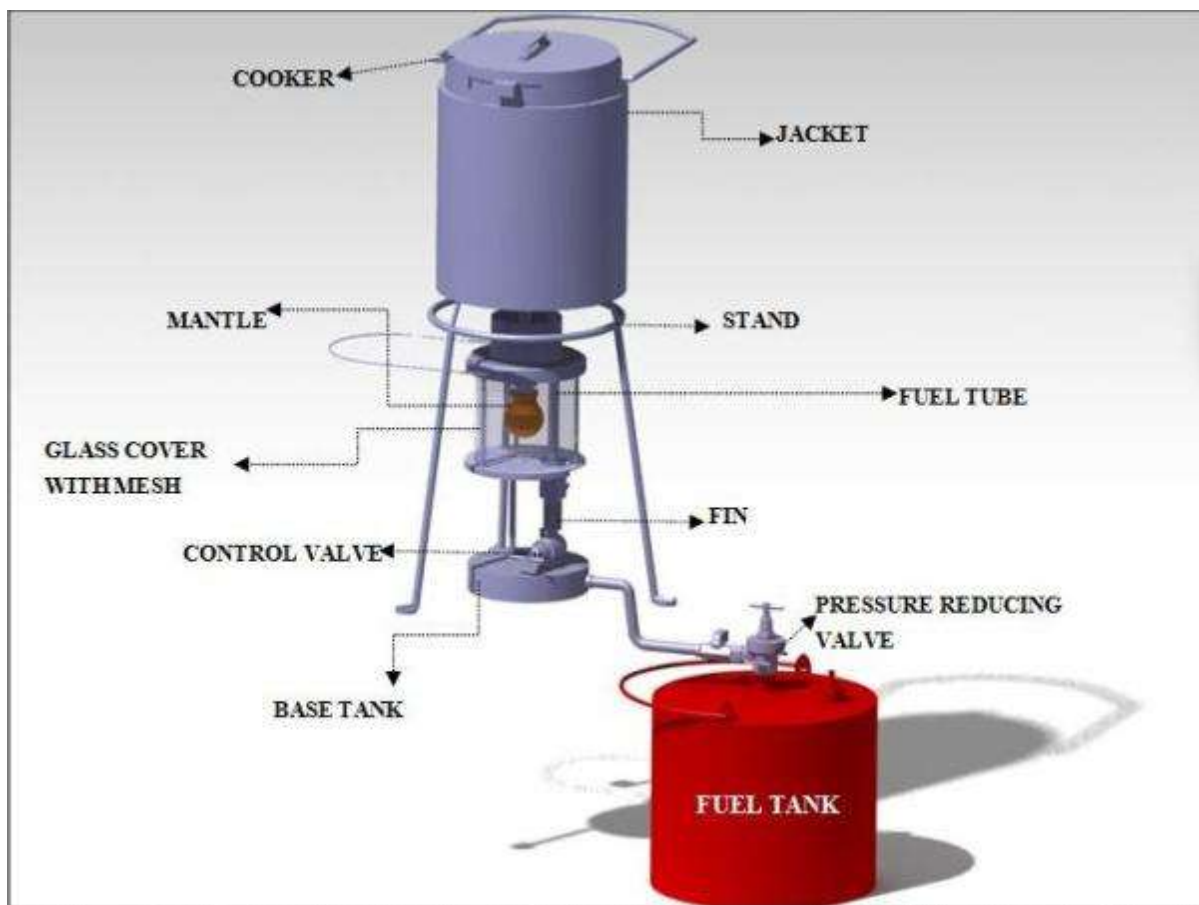
Highlights :

1. Dr. Anil K. Rajvanshi was featured on the [front page of Mechanical Engineering newsletter \(Spring 2015\) of University of Florida](#). The feature story detailed the work being carried out at NARI.
2. Dr. Anil K. Rajvanshi was invited by the Dean of Engineering, University of Florida to give a talk to freshmen engineers. The talk given on 17 July 2015 to 100 + students and faculty and entitled [“How to become good engineers”](#) was very well received.
3. Dr. Anil K. Rajvanshi was invited to give a talk at the Times of India-sponsored seminar “Organ donation”. The seminar was held on 8 August 2015 at the Kokilaben Ambani Hospital and Medical Research Institute in Mumbai and was [widely covered in print](#) and TV media.
4. Dr. Anil K. Rajvanshi was invited as the chief guest to Emerson Innovation Centre, Pune on Technology Day (15 September 2015). He gave a talk to 300 + engineers and senior managers entitled [“Innovation for forgotten Indians – How corporate world can improve their lives”](#).
5. Dr. Anil K. Rajvanshi was invited to [give a talk to the students of IIT Kanpur](#) on 26 September 2015. This was a part of Project Saraswati organized by the Alumni Contact Program and Dean of Resources and Alumni (DORA), IIT Kanpur.
6. Dr. Anil K. Rajvanshi gave a talk entitled [“How to live a sustainable life for producing happiness”](#) to Lucknow Management Association, Lucknow, 28 September 2015.
7. Dr. Anil K. Rajvanshi was invited by NATURE (India) to attend the International Conference on Consciousness, organized by NIAS, Bangalore and held from 9-12 December 2015. His article on the conference [was carried by NATURE \(India\) in their newsletter](#).

Projects :

A. Diesel lanstove :

Further modifications and improvement were continued in diesel lanstove (pictured) and we now feel that it is far better than kerosene lanstove in its performance. Under laboratory conditions it



has logged more than 700 hours of running during last year. Further tests are being done and we feel that it should be ready for commercialization soon. The table below shows the salient features of the diesel lanstove.

Summary Table for Diesel Lanstove from June 2015-March 2016

No	Property	Units	Values	Data Size(number of experiments)
1	Light output (Brodhum Photometer test)	Lumen	860-1105	9
2	Tank Volume	Liters	7	
3	Tank Pressure	Bar	3.0-4.5	
4	Efficacy	Lumen/Watt	0.52-0.70	9
5	Efficiency (boiling tests)	percentage	40-48	71*
6	Heat Output	Watt	850-1700	234
7	Diesel Consumption	g/minute	1.2-2.4	234
8	Efficacy of Cooking (kg of food cooked/100g of fuel)	Kg/100g	0.3-3	15
9	Boiling time for 5 liters of water	Minutes	30-40	71
10	Average daily run output		Light for 4 hours Food for 5 persons cooked in 2 hours 15 liters water boiled in 2 hours	234 total runs 15 cooking tests 71 boiling tests
11	Controls		Turn down ratio of 2:1	138 hours
12	Weight of Lanstove with Market Control Valve (without diesel)	Kg	8.027	
13	Weight of Lanstove with Fabricated Valve (without diesel)	Kg	7.800	
14	Total run time from June 2015-March 2016	Hours	802	

* 127 minutes average run time

B. Solar water purifier/refrigerator :

The work on Solar water purifier (pictured) has continued. In May 2015, a [major story on this project came in 'Better India'](#) with the result that it was widely covered in social media like Facebook and Twitter. Large number of inquiries were received from all over the world. [The main documentation](#) was sent to all of them for possible fabrication.



We are now looking at the possibility of designing an absorption refrigeration unit to produce ice from the clean heated water. This ice can be given in an insulated box to the rural huts to be used as household refrigerator. Estimates show that 0.14 kg of ice can be produced per liter of water purified (based on 80⁰C hot water from the purifier).

For a village with an average population of 3000 one needs about 30,000 l/day of clean water for cooking and drinking. This translates into about 40 liters per household.

It is envisaged that a micro-utility company having a capacity to produce 5000 liters of purified water per day using our system can also produce 700 Kg of ice/day.

Efforts are on to design and fabricate a pilot system of 100 l/day capacity.

Scientists : Dr. Anil K. Rajvanshi, Mr. J. B. Rao

Technical staff : Mr. A. M. Pawar, Mr. Nitin Bhongale, Mr. S. C. Madane, Mr. Vijay Gonugade,
Mr. A. D. Nale, Mr. S. D. Awate

Interns : Mr. Akshay Kumbhar, Mr. Amol Dalvi

Animal Husbandry Division (AHD) Research

Highlights

1. Wider dissemination of NARI's 'NARI Suwarna' sheep :

- (i) Mahatme Sheep Farm Training and Research Centre in Nagpur has established a nucleus flock of NARI Suwarna by mating a NARI Suwarna homozygous ram from NARI-AHD with 50 local ewes. They intend to popularize and disseminate this breed among local sheep rearers.
- (ii) With the support of the Government of Karnataka, the 'NARI Suwarna' strain with a 70% higher twinning proportion than Deccani or Bellary sheep is becoming more popular in some districts of Karnataka because of its higher profitability. **Sixty superior NARI Suwarna rams were distributed to sheep rearers in Tumkur district** by the Karnataka Government on 23 April 2015.



Beneficiaries with their NARI Suwarna rams procured by the Govt. of Karnataka from NARI and distributed at a 90% subsidy to sheep rearers in Tumkur district of Karnataka

The distribution was done under the Karnataka Animal Husbandry Department's 'Bhoochetana' Scheme by Mr. T.B. Jaychandra, the Karnataka Minister for Law, Human Rights, Parliamentary Affairs and Animal Husbandry, and the Guardian Minister for Tumkur district. Dr. Chanda Nimbkar, Director, AHD-NARI was present at the function. There are about 10 lakh sheep in Tumkur district, 4.5 lakh of them in Tumkur taluka. The rams were given to sheep owners in Tumkur, Tiptur, Sira and Madhugiri talukas after they paid 10% of the price. (The Karnataka Government paid the remaining 90%). Out of the 60 rams, 53 were supplied by NARI-AHD while seven were sourced from the flock of a smallholder sheep owner Mr. Doddaraju of Veerapura village in Sira taluka of Tumkur district. Mr. Doddaraju had originally purchased 10 pregnant NARI Suwarna ewes from NARI-AHD and has now built up the numbers of NARI Suwarna sheep in his flock. So far, he has got 114 of his animals genotyped at the *FecB* locus by sending their blood samples to NARI-AHD. The seven rams from his flock that were distributed to other shepherds by the

Karnataka government, were genotyped at NARI-AHD and found to be homozygous for the *FecB* gene.

Another batch of 40 rams was also supplied by NARI to Government of Karnataka on 8 March 2016 for distribution to sheep rearers in Sira and Tiptur districts of Karnataka.

The rams carry two copies of the ‘twinning’ gene *FecB* and will transmit one copy to each progeny. The daughters that will be born after the ‘NARI Suwarna’ rams are mated to local sheep, will therefore have the ability to have twin or triplet instead of single lambs and will give at least 70% more lambs than ordinary local sheep if fed and managed properly. This will lead to a substantial increase in mutton production and the incomes of sheep owners. The *FecB* gene will remain in the flock so long as the individuals carrying the gene are used for breeding.

2. Heterozygous *FecB* carrier ewes in NARI’s nucleus flock produced 40% more lambs per pregnant ewe than *FecB* non-carrier ewes.
3. Since 2012 when NARI-AHD’s frozen semen laboratory was commissioned, about 36,000 buck semen straws have been produced and 26,000 of these have been disseminated in 10 Indian states and in Nepal (14,000 doses of 77 Boer bucks, 8700 of 37 Osmanabadi bucks, 2100 of 13 Damascus cross bucks and 1200 of three Alpine X Beetal bucks)
4. For the first time since the AHD started offering training courses in Artificial insemination in Goats, four trainees (one woman and three men) from Afghanistan undertook AHD’s training course on 17-20 June 2015. It is a matter of great pride to us that these trainees were associated with the Cashmere Goat Development Project carried out by the Colorado State University, U.S.A. in Herat Province of Afghanistan with funding from the U.S. Defence Department. Colorado State University personnel specially contacted Dr. P.M. Ghalsasi of NARI-AHD and requested for such a special training course.



Ms. Roya Ansari and her colleagues from the Noor Group, Afghanistan learning how to do ultrasonography and A.I. in goats in a training course at NARI-AHD

5. In April 2015, the Food and Agriculture Organization of the United Nations (FAO), Rome, finalized *The Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture*. They invited NARI-AHD to submit a text box describing NARI-AHD's achievements in buck and ram semen freezing and AI technology, for this publication. A text box was accordingly submitted and is published in this prestigious global publication.
6. In June 2015, Dr. Chanda Nimbkar, the Director of the AHD, was invited to serve on the Board of Trustees of the International Livestock Research Institute (ILRI), a CGIAR organization based in Nairobi, Kenya but working in a multitude of developing countries worldwide. The Board provides the overall governance for ILRI and Board members play a crucial role in providing strategic program direction and fiduciary oversight. Dr. Nimbkar has accepted this prestigious appointment and is currently the Deputy Head of the Program Committee of the ILRI Board.
7. A Memorandum of Understanding was signed between Nimbkar Agricultural Research Institute, Phaltan and Maharashtra Animal and Fishery Sciences University(MAFSU), Nagpur, in August 2015 for collaboration in various research activities of common interest through constituent colleges of MAFSU.
8. Under the above MOU, an MVSc student from the Department of Animal Genetics and Breeding of Bombay Veterinary College, Ms. Prachi Vaidya, collected blood samples of 30 NARI Suwarna rams from AHD's Wadjal farm on 30 April 2015. She carried out a cytogenetic evaluation and found no chromosomal abnormalities. The results were written up in her MVSc thesis.
9. Mrs. Surekha Kalel of Manndeshi Foundation in Mhaswad in Mann taluka of Satara district was trained by NARI-AHD in doing artificial insemination in goats. She is carrying out AI successfully and also training more women in the technique. Up till now she has inseminated total 265 local does with Boer, Damascus cross, Alpine X Beetal and Osmanabadi buck frozen semen, out of which 219 were followed up and 135 does were found to have kidded. Thus she achieved a 62% conception rate for frozen semen.



Mrs. Surekha Kalel giving information about AI and inseminating a village goat

Project I. Osmanabadi Goat Field Unit of the ICAR-All India Coordinated Research Project on Goat Improvement

Funding agency : Indian Council of Agricultural Research (ICAR), Government of India, New Delhi, administered by the Central Institute for Research on Goats, Makhdoom, Via Mathura, U.P.

Scientists : Dr. Chanda Nimbkar, Dr. Pradip Ghalsasi

Technical staff : Mr. Kanhaiya Chavan, Mr. Navnath Patange, Ms. Bharati Pawar, Mr. Sachin Kakade, Mr. Rupsing Khanvilkar, Mr. Swanand Shinde, Mr. Haribhau Thombare (in Kamone, Dist. Solapur), Ms. Surekha Murumkar (in Sakat, Dist. Ahmednagar), Mr. Amol Patil (in Alkud, Dist. Sangli)

1. Executive Summary

Production performance of goat breeds in farmers' flocks under village management system and improvement of the germplasm through selection

- i. An **Osmanabadi goat field unit was established at NARI in April 2009** under the AICRP on Goat Improvement. In 2015-16, the production performance of goats in farmers' flocks was assessed in four villages in four districts (one village in each district) in western Maharashtra state. viz. Satara, Solapur, Ahmednagar and Sangli districts.
- ii. The work of **refining and fine-tuning the MS Access database of the Osmanabadi field unit and putting it on the SQL platform for ease of data entry and data retrieval is almost finished.**
- iii. Six hundred and fourteen adult does (84, 204, 151 and 175 adult does in Satara, Solapur, Ahmednagar and Sangli districts respectively) are being recorded. These belong to 192 goat keepers, indicating that about three goats are reared per household on average. Detailed periodic recording has been done of their body weight, milk yield, reproduction, kid weights, mortality, morbidity, cost incurred for goat rearing and income earned.
- iv. 1177 kids were born in 709 kiddings during 2015-16, making the average litter size 1.66 which is slightly lower than 1.68 in 2014-15.
- v. The least squares mean three month weight of single-born kids (532 records) was 10.4 ± 0.1 kg and that of twin-born kids (1566 records) was 9.1 ± 0.1 kg. Thus **does giving birth to twin kids produced almost 75% more kid weight at 3 months' age** than does giving birth to single kids. Similarly, the weight of single-born and twin-born kids was 16.5 and 14.3 kg respectively at 6 months' age, giving a 73% superiority of twinning goats in weight of kids produced. The **overall least squares mean three month weight of Osmanabadi kids in this study was 10.5 ± 0.2 kg** which was higher than the ~7 kg reported in the report of the Network Project on Osmanabadi Goats, MPKV, Rahuri (1995-99).

- vi. The least squares mean 100-day milk yield was 114 litres. The 100-day milk yield of does that had single, twin and triplet kids was 68.9 kg, 103.7 kg and 139.2 kg respectively, indicating that milk yield increases with the number of kids.
- vii. Mortality across all age groups and sexes was 6.1%. Mortality was similar among kids and adults. The major cause of mortality among adults was respiratory failure while it was diarrhoea/enteritis in kids.
- viii. Four more twin-born bucks were purchased from the field in 2015-16, with six months weights of 16 to 19 kg and dam's milk yield 1 to 1.8 litres per day. The total number of bucks purchased since 2009 is 41.
- ix. About 9,575 straws (0.25 ml French mini straws) of frozen semen of 30 Osmanabadi bucks have been produced so far in NARI's Frozen Semen Laboratory. During 2015-16, 1489 Osmanabadi buck straws were supplied to A.I. technicians and farmers for breeding Osmanabadi goats. Conception rates of 50 to 55% have been reported by field technicians.

Dissemination of pro-poor goat based technologies under field conditions

- x. Eight information booklets in Marathi language have been distributed to participating and other goat keepers for better goat management practices.
 1. First aid treatment in sheep and goats – one booklet and one folded leaflet
 2. Vaccination in sheep and goats - folded leaflet
 3. Abortions in sheep and goats : prevention, treatment, nursing and precautions to be taken to avoid infection to humans
 4. Misconceptions and superstitions in livestock treatment
 5. Adverse effects of early breeding of young does: consequences and prevention
 6. Goat rearing package of practices for small holders
 7. Package of practices for goat artificial insemination (AI)
 8. Economics of stall-fed goat production
- xi. Regular preventive health care of goats was carried out in all villages including vaccinations, deworming and spraying against ecto-parasites.
- xii. Goat keepers were trained in preventive health care of goats and first-aid treatment so that they can care for their goats themselves instead of having to rely on others.
- xiii. Due to training and awareness creation by Project personnel, 65% of the Osmanabadi goat kids sold for slaughter by their owners, were sold at the rate of more than Rs.200 per kg live weight. This is a high rate considering that meat is sold for Rs.350 to Rs.400 per kg.

There is substantial decrease in sudden mass mortality and significant improvement in health of animals due to vaccination and timely treatments.

- xiv. During 2013-15, fodder seed of the legumes *Desmanthus virgatus* and *Stylosanthes seabrana* and of a multi-cut fodder sorghum variety COFS-29 developed by the Tamil Nadu Agricultural University have been supplied to 42 participating goat owners.
- xv. Another new village will be adopted in the Alkud cluster in Sangli district.

2. Salient Achievements

- i. **Incomes** of adopted goat keepers have **increased** because of better management and feeding of their goats due to awareness created and services provided by the Osmanabadi Field Unit.
- ii. **Capacity building** : Due to training and awareness creation by Project personnel, 65% of the Osmanabadi goat kids sold for slaughter by their owners, were sold at the rate of more than Rs.200 per kg live weight. This is a high rate considering that meat is sold for Rs.350 to Rs.400 per kg.
- iii. **Genetic improvement and its dissemination**: Superior Osmanabadi breeding bucks are purchased and reared for breeding and their frozen semen made available for goat keepers and areas where good breeding bucks are not available. Thus the quality of the Osmanabadi breed is being improved constantly. This is even carried out in 10 non-adopted districts of Maharashtra and one district of Karnataka State. During 2015-16, Mrs. Surekha Kalel, AI technician of Manndeshi Foundation inseminated 25 does with Osmanabadi buck frozen semen, out of which 21 were followed up and 12 does were found to have kidded. Thus the conception rate for frozen semen was 57%.
- iv. **Wider awareness creation** : The P.I. wrote an article in the leading Marathi agricultural daily newspaper Agrowon about how the Osmanabadi goat can be elevated to the status of a world-class meat producing goat breed if systematic genetic improvement is carried out over the long term (>40 years). Hundreds of visitors visit our institute annually and are given information about the work of the Osmanabadi Field Unit.
- vi. Authentic data on Osmanabadi goats are being collected in different regions of Western and Central Maharashtra.

3. Characterization of goat production system

The Osmanabadi goat production system is characterized by small flocks. The average flock size is three goats but there are a few larger flocks with 15-20 goats. These goats are thus reared by smallholder farmers and landless labourers. The goats are taken out for grazing on crop residues when available and on farm bunds and open/empty lands or hills where available. Sometimes two or three owners graze their flocks together. Some supplementary feeding of kidded does and growing kids is done. Droughts are frequent in this region of the Deccan plateau and the goats are adapted to periodic fodder shortage. However, they regain condition once the rains start and grass becomes available plentifully. Most kids are sold for meat to traders and butchers who come to the goat keepers' houses or in markets. Clever goat owners can earn a daily wage of Rs.300 from goat rearing.



4. Buck distribution and its impact

12 bucks have been distributed during 2015-16. Data analysis is being done for ranking of bucks based on performance of their progeny.

5. Genetic parameters

It is difficult to estimate genetic trends because of the absence of a good pedigree structure in the data and the lack of knowledge of all pedigree relationships. The project work in some of the villages was stopped during the course of the project due to various reasons such as non-cooperation from goat keepers and unwillingness to maintain breeding bucks, non-performance of the collaborating organization in one cluster, reduction in number of goats in the village due to drought or other reasons and use of unselected bucks by goat keepers for breeding. This was a major obstacle in the way of any consistent genetic trend. Work was started in some new villages in different years of the project. The progeny in these new villages was therefore not the progeny of bucks distributed by the Field Unit. However, an attempt will be made to estimate the genetic trend and present it during the annual review meeting.

6. Training organized :

A training course was carried out in Phaltan, Maharashtra by staff of the Osmanabadi Field Unit on 16-22 January 2016 on 'Advanced methods of goat production and artificial insemination in goats' for five staff members including the Principal Investigator and Senior Research fellow of AICRP - Changthangi Goat Unit in Leh, Ladakh.

In this training the following practical aspects of goat management were taught.

- 1) **Artificial insemination in goats** : Heat detection, thawing of frozen semen and cervical artificial insemination in goats.
- 2) **Use of fresh diluted and chilled semen**: Semen collection of bucks at village level and dilution with different diluents, short term storage in straws and use for artificial insemination under field level.

- 3) **Goat Management:** Estimation of age by dentition, body condition scoring, grouping of goats as per their body condition and concentrate feeding, methods of castration and giving injections.
- 4) **Preparation prior to village visits :**
 - Planning of village visit – detailed list of goats, list of kidded goats for milk records, checking goats as per visit list and taking records as per actual conditions of goats.

7. Technology transfer and validation in field flock

1. In the newly adopted village Alkud in Sangli district, goats belonging to two goat keepers in the main village and most of the goats in the Panchsheel Nagar area of the village had bad tick infestations. We educated the goat keepers about keeping clean the area where they tie up their goats and we sprayed the anti-tick preparations such as Butox on all the goats as well as their cattle and cattle sheds. All the goat owners cooperated and cleaned up the surroundings of the goats. One goat owner moved his goats out to his field for 1.5 months to terminate the life cycle of ticks in the goat pen near his house. As a result, all the goats and cattle in this village are free of ticks now.
2. In the new village of Alkud, no good breeding bucks were available. We have now given four excellent quality breeding bucks there and the kids sired by them are outstanding.
3. Three goat owners in Kamone village, Nagesh Kharat, Nathabhau Kharat and Hanmant Kharat have become adept at treatment of their sick goats due to the frequent training sessions given by our extension officer and workers to a ‘pashumitra’ group of which they were members. They also learnt from the proper treatment protocols followed by our workers.
4. In all our clusters, goat keepers are well aware about weighing their goat kids before sale. Around 900 kids were sold during the year by the goat keepers. Sixty five per cent of them (587 kids) were sold for more than Rs. 200 per kg live weight.

8. Dressing percentage of Osmanabadi goats

Dressing percentage of 4.5 to 8 months’ old goat kids slaughtered at the annual fair in Wadgaon village in Satara district in April 2015, was estimated. When meat and all the body parts that villagers eat (excluding only blood, ingesta and skin), were considered, the average dressing percentage was 67.8% while in addition to blood, ingesta and skin if head and hooves, digestive system and testicles were excluded, the dressing percentage was 53.5%.

No. of kids recorded	Live weight range (kg)	Average Live weight (kg)	Average weight of edible meat and organs (excluding blood, ingesta, skin) (kg)	Dressing %	Average weight of edible meat and organs (excluding blood, head and hooves, ingesta, digestive system, skin, testicles) (kg)	Dressing %
5	11.4 to 22.8	17.8	12.14	67.83	9.57	53.47

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

We are proud to say that this breeding programme has continued to be self-sustaining. The revenue generated from sale of breeding animals can cover the expenditure on sheep maintenance and pasture and fodder cultivation for the sheep.

Scientists: Dr. Chanda Nimbkar, Dr. Pradip Ghalsasi

Technical staff: Mr. Rupsing Khanvilkar, Mr. Vikram Shedge, Ms. Padmaja Ghalsasi

A. Breeding programme

All ewes are bred by artificial insemination (AI) in order to use a large number of breeding rams and maintain accurate pedigree records. Each of the four AI programmes in 2015-16 went on for one month, roughly covering two oestrus cycles. Ewes were inseminated in natural oestrus detected by vasectomized teaser rams. All ewes were inseminated cervically once, about 12 hours after oestrus detection. Ewes were inseminated with fresh, diluted semen of the allotted rams. The high conception rate achieved (78 to 84%) indicates the high standard of practices used for the AI programme. Adequate numbers of unrelated breeding rams were used to keep inbreeding under control. Genetic analysis was used to estimate breeding values.

A new strain of Deccani sheep has been developed, called 'NARI Suwarna', that gives about 40-60% higher lamb production due to almost twice the proportion of twinning as in local Deccani sheep. The growth rate, mothering ability and conformation of the new breed were improved by the introduction of the Madgyal breed and continuous selection is being carried out to improve these traits further. The breed has been disseminated to shepherds in Maharashtra, Karnataka and Andhra Pradesh and they are profiting from its use. So far, about 500 breeding rams and 680 breeding ewes have been supplied. Out of these, 168 rams and 130 ewes were supplied during 2015-16. This year, 40 ewes and 43 rams were procured by sheep rearers from Pune, Solapur and Satara districts of Maharashtra. This is an encouraging sign as it means the shepherds from nearby localities are slowly realizing the profitability of NARI Suwarna.



In our selected nucleus flock, on 10 August 2016, there were 90 $FecB^{BB}$ adult ewes (homozygous for the $FecB$ allele), 214 $FecB^{B+}$ adult ewes (heterozygous for the $FecB$ allele) and 49 non-carrier adult ewes, making a total of 353 adult ewes. In addition, there were 54 young ewes (29 $FecB^{BB}$ and 25 $FecB^{B+}$) that were 4 to 11.5 months old. There were 15 adult, breeding rams, comprising of 8 $FecB^{BB}$, 6 $FecB^{B+}$ and 1 non-carrier Madgyal rams. Additionally, there were about 60 selected young $FecB$ carrier breeding rams for use and dissemination. These animals are either NARI Suwarna (with only Deccani and Madgyal breed proportion and less than 10% Garole breed proportion) or NARI Composite (with additional Awassi and/or Bannur breed proportion). Madgyal rams are being used in NARI's breeding programme to improve the physical appearance and conformation of crosses in such a way as to make them 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 area and many other areas of Maharashtra.

Table 1. Details of AI programs carried out at NARI's Lundy farm, Rajale in January, April, August and November 2015

Particulars	Ewe's $FecB$ genotype			Total
	$FecB^{BB}$	$FecB^{B+}$	$FecB^{++}$	
Ewes available for breeding	137	362	85	584
Ewes inseminated artificially (AI)	115	274	68	457
Ewes conceived (first and second AI + NS)	97	240	61	398
Conception rate of first AI (%)	78.9	78.7	84.7	79.6
Pregnant ewes died	0	0	0	0
Ewes aborted	5	7	2	14
Ewes lambed with at least one live lamb	73	214	58	345
Ewes lambed with all lambs stillborn or died soon	19	17	1	37
Total live lambs born	114	345	64	523
Live lambs born per ewe lambed with at least one live lamb	1.56	1.61	1.10	1.52
Live lambs born per ewe lambed or aborted or with all lambs stillborn	1.17	1.45	1.05	1.32
Live lambs born per ewe conceived	1.17	1.44	1.05	1.31

Thus *FecB* homozygous and heterozygous ewes produced 11% and 37% more live lambs per ewe conceived than non-carrier ewes. This performance of heterozygous ewes is in accordance with earlier records. However, homozygous ewes had a much higher proportion of stillbirths this year. They produced 42% more total lambs per ewe having at least one live lamb compared to non-carrier ewes but only 11% more per ewe when ewes that had stillbirths were included. The performance of heterozygous ewes was comparatively much better as 89% of pregnant heterozygous ewes produced live lambs while only 75% of pregnant homozygous ewes produced live lambs. **More research needs to be done on reducing the embryonic mortality in homozygous ewes. We have been able to reduce this mortality to some extent by improving pregnant ewes' nutrition from mid-pregnancy i.e. the second month of pregnancy instead of in the fourth month of pregnancy.**

B. Genotyping of sheep DNA at the *FecB* locus :

Table 2. *FecB* genotypes of sheep belonging to NARI tested at the AHD laboratory during 2015-16

Breed	Number of animals genotyped	<i>FecB^{BB}</i>	<i>FecB^{B+}</i>	<i>FecB⁺⁺</i>
Garole and crosses	3	0	3	0
Crossbred NARI Suwarna lambs*	272	83	138	51
Confirmation of genotypes initially determined on pedigree	23	14	8	1
Total	298	97	149	52

* There were no discrepancies in the *FecB* genotypes of parents and progeny.

Table 3. *FecB* genotypes of blood samples received from outside NARI

Source of samples	Breed	Number of animals genotyped	<i>FecB^{BB}</i>	<i>FecB^{B+}</i>	<i>FecB⁺⁺</i>
King Saud University, Saudi Arabia under the Project: Introgression of <i>FecB</i> gene into Awassi and Najdi sheep	Awassi and Najdi sheep crosses	294	14	138	142
Shepherds from Karnataka State, mainly Tumkur district, having NARI Suwarna ewes and/or rams	NARI Suwarna X Bellary / NARI Suwarna	51	33	18	0

This year there were a lot of problems in the *FecB* genotyping test which resulted in initially getting only 40-50% of samples amplifying, which later improved to 65-70% samples amplifying at first go. A consultant, Ms. Sheetal Ranade, was hired to help with trouble-shooting and the success rate improved after making the changes suggested by her.

The following alterations were made in the protocol of the FecB genotyping test.

I) DNA Extraction :

- One extra Alkali (20mM NaOH) wash was given to the FTA paper punch in order to minimize contaminants. The total incubation time of 30 minutes was divided into 15 minutes after each wash.
- After the NaOH wash, the punches were further washed twice with Tris EDTA T₁₀E_{0.1} of pH 8.
- Now 30µl sterile water is added to the washed pellet instead of 20µl, again to dilute any contaminants present which may act as inhibitors in the PCR reaction.

II) Source of sterile water

- DNase and RNase-free water was purchased and used in all the preparations and reactions to avoid any chance of contamination in our own water purification unit.
- We also had a professional visit to clean and flush out our water purification unit to remove all the impurities. Now the water from our unit is completely sterile and free of impurities.

III) PCR :

- The MgCl₂ concentration was increased to increase the activity of the Taq enzyme.
- The temperature of Initial Denaturation of the DNA was reduced by one degree in the PCR cycle (from 95°C to 94°C).

Project III. Setting up a State of the Art A.I. Centre for sheep and goats under the National Livestock Mission Scheme under the component of 'Interventions towards productivity enhancement'. (This project was originally sanctioned under the Central Sector Scheme – Integrated Development of Small Ruminants and Rabbits.)

Scientists : Dr. Pradip Ghalsasi, Dr. Chanda Nimbkar

Technical Staff : Mr. Kanhaiya Chavan, Mr. Rupsing Khanvilkar, Ms. Padmaja Ghalsasi, Ms. Nusrat Patel, Mr. Dattatray Mulik

Funding agency (only for equipment and buck purchase) : Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Government of India, New Delhi.

Total amount : Rs.199.73 lakh

Date of sanction : 24 November 2010

The total amount of the third and fourth instalment of Rs.50 lakhs received by NARI on 23 August 2013 was utilized mainly for the civil construction of a new custom-built buck semen freezing laboratory. Additionally, NARI purchased 20 Osmanabadi and 5 Boer bucks in March 2014 as per the provision made in the A.I. Centre budget.

Since obtaining the funding, NARI has

- Set up a full-fledged, modern laboratory for cryopreservation of buck semen, using funds from the government grant as well as its own funds where necessary.
- Overcome many obstacles in setting up and operating the semen freezing laboratory as no standard designs for buck semen freezing laboratories were available. Tackled the difficulties of functioning in a remote rural area with problems such as erratic electricity supply that are ever present.
- Standardized buck semen freezing technology to produce high quality frozen semen straws.
- Produced 36,000 and disseminated about 26,000 buck semen straws in 10 Indian states and in Nepal (14,000 doses of 77 Boer bucks, 8700 of 37 Osmanabadi bucks, 2100 of 13 Damascus cross bucks and 1200 of 3 Alpine X Beetal bucks).
- Established goat AI technology in India where it was widely considered to be 'failed' or 'not workable'.
- Made available at reasonable prices, improved germplasm of high yielding exotic (pure Boer, Damascus (crosses), Alpine x Beetal) and improved indigenous (Osmanabadi) breeds. (Osmanabadi bucks are selected from villages from among twin-born kids with fast growth rates and having mothers with high milk yields of around 2 litres per day. This is done under the All India Coordinated Research Project on Goat Improvement, funded by the Indian Council of Agricultural Research).
- Ensured semen availability at the doorstep of smallholder goat keepers by popularizing goat AI among AI technicians who inseminate cows and buffaloes in villages and can use the same AI gun in goats.
- Set up a goat AI service provided by six women in collaboration with the Manndeshi Foundation in Mhaswad in Satara district. The women carry out AI in five talukas in three districts in South-Central Maharashtra.
- Obtained an order for 40,000 Osmanabadi buck semen straws from the Government of Karnataka.

NARI's pioneering initiative is thus increasing incomes of smallholder goat keepers through higher growth rates and meat yields of their goat kids born from AI. The semen freezing laboratory has the capacity to produce 1.25 lakh straws per year. This can be expanded to 7.5 lakhs with a few modifications. NARI would be happy to help establish goat AI technology in other goat development projects in India and other developing countries.

Table 4. Year wise production and utilization of buck frozen semen doses during the period January 2012 to April 2016.

Buck Breed	Previous balance	Production	Total	Utilized	In storage
2012					
Osmanabadi (indigenous breed)	0	2671	2671	379	2292
Boer (South African meat breed)	0	1758	1758	1314	444
Damascus cross (Middle Eastern dual purpose breed)	0	280	280	148	132
Total A	0	4709	4709	1841	2868
Buck Breed	Previous balance	Production	Total	Utilized	In storage
2013					
Osmanabadi	2292	4777	7069	5257	1812
Boer	444	3866	4310	2958	1352
Damascus cross	132	438	570	253	317
Alpine X Beetal (dairy goat)	0	831	831	225	606
Total B	2868	9912	12780	8693	4087
2014					
Osmanabadi	1812	1557	3369	1465	1904
Boer	1352	5331	6683	3081	3602
Damascus cross	317	1088	1405	964	441
Alpine X Beetal	606	493	1099	580	519
Total C	4087	8469	12556	6090	6466
2015					
Osmanabadi	1904	831	2735	1575	1160
Boer	3602	4406	8008	6290	1718
Damascus cross	441	917	1358	721	637
Alpine X Beetal	519	312	831	423	408
Total D	6466	6466	12932	9009	3923
Up to April 2016					
Osmanabadi	1160	4528	5688	88	5600
Boer	1718	1555	3273	654	2619
Damascus cross	637	304	941	11	930
Alpine X Beetal	408	0	408	2	406
Total E	3923	6387	10310	755	9555
Grand Total A+B+C+D+E		35943		26388	9555

Five hundred frozen semen straws of Osmanabadi bucks were given for conservation to the National Bureau of Animal Genetic Resources, Karnal, Haryana under the technical program of the ICAR-All India Coordinated Research Project on Goat Improvement - Osmanabadi field unit at NARI.

Table 5. Names of some AI technicians who procured Frozen semen from NARI-AHD for AI of local goats in villages

Sr. No.	Name, address and contact no.	Straws supplied	Straw supply period	Conception rate reported by technicians (%)
1.	Shri Vipul Shingade At Malshiras, Dist. Solapur + 91 9860364766	375	August 2012 to June 2016	55
2	Manndeshi Foundation At Mhaswad, Dist. Satara Maharashtra + 91 9766563984	1100	December 2013 to June 2016	60
3	Shri Sachin Durgude At Shirasne, Tal. Baramati, Dist. Pune, Maharashtra +91 7709860826	146	April 2014 to June 2015	45
4	Shri Padmakumar Patil At Talani, Tal. Mutala, Dist. Buldhana, Maharashtra + 91 9552176332	46	October 2013	50
5	Shri Rajkumar Devkate At. Mekhali, Tal. Baramati Dist. Pune, Maharashtra + 91 9850303774	71	April 2014 to March 2016	80
6	Shri Shiram S. Bothekar At & Tal Phaltan, Dist. Satara Maharashtra + 91 9422607816	208	August 2012 to June 2016	70
7	Shrirampur Doodh Zilla Madhyawarti Dudh Vyavasaik Sangh, At Babhaleshwar, Tal. Shrirampur, Dist. Ahmednagar, Maharashtra + 91 2422 253509 / 253510	200	August 2015 to February 2016	50
8	Shri Mahendra Salunkhe. At Jinti, Tal. Phaltan, Dist. Satara Maharashtra +91 9970330320	132	November 2014 to September 2015	40
9	Shri Hemant Kadam At Girvi, Tal. Phaltan, Dist. Satara, Maharashtra +91 7588059121	161	September 2015 to June 2016	70-80
10	Shri Laxman Narayan Khambat At Sillod, Dist. Aurangabad Maharashtra	140	December 2015	60

	+ 91 9421427394			
11	Shri Dattatray Holkar At Hol, Tal. Baramati, Dist. Pune, Maharashtra + 91 9423002681	110	June 2014 to June 2015	61
12	Shri Azruddin Momin At Belwade khurd, Tal. Kagal Dist. Kolhapur, Maharashtra + 91 9975640642	50	January 2015	30
13	Shri Anand Jadhav, At Sakharwadi, Tal. Phaltan, Dist. Satara, Maharashtra + 91 9766388091	74	September 2012 to December 2015	60
14	Shri Hanumant Tumarmatti Bhantanur. Tal. Mudhol, Dist. Bagalkot, Karnataka + 91 9741635853	60	2016	40
15	Basundhara Agrotech and Services Pvt. Ltd, Nepal	820	April 2015	60

AI technicians who are carrying out AI in cattle and buffalo have now started keeping buck semen straws in addition to cattle and buffalo semen in their semen storage containers. NARI gives demonstration of cervical insemination in goats to AI technicians when they visit NARI to buy semen. NARI has prepared a video clip on cervical goat AI. This video clip is shown to AI technicians when they visit NARI. AI technicians interact with NARI staff regarding their problems in goat AI and also take details of follow-up of goat AI done by them. NARI has supplied printed notebooks to technicians for keeping AI records.

Table 6 : Frozen semen straws supplied by NARI to Indian states and foreign countries from June 2012 to end of June 2016

State/country where buck frozen semen straws supplied	Number of straws supplied
Andhra Pradesh	90
Assam	200
Bihar	200
Gujarat	20
Karnataka	595
Madhya Pradesh	55
Maharashtra Government Animal Husbandry Department	5000
Maharashtra – private AI technicians and farmers	10,146
Rajasthan	485
Tamil Nadu	3710
Uttaranchal	125
Nepal	1720
Total	22,346

Project IV. Research in veterinary parasitology with special reference to sheep and goats.

Funding agency : internally funded

Scientists : Dr. Chanda Nimbkar, Dr. Pradip Ghalsasi

Technical staff : Ms. Padmaja Ghalsasi, Ms. Nusrat Patel, Mr. Kanhaiya Chavan, Mr. Rupsing Khanvilkar, Mr. Vikram Shedge, Mr. Dattatraya Mulik, Mr. Anil Chavan

This year also the gastro-intestinal (GI) worm burdens due to natural infection of NARI's sheep and goats and of goats belonging to goat keepers participating in the ICAR-AICRP Goat Improvement Project 'Osmanabadi Field Unit' were monitored and the animals were treated as required. Animals were dewormed either *en mass* or Targeted Selective Treatment (TST) was done depending on the severity of the worm burden.

The faecal samples were evaluated by the Modified McMaster Technique through which GI nematode eggs can be quantified and also infection due to Tapeworm (Cestodes) and coccidia (gut protozoa) can be identified.

The general findings in farmers' goat flocks were:

- Some of the kids were severely affected by Tapeworm infection, some due to coccidia.
- There was an outbreak of severe diarrhoea in kids belonging to Nimbkar Seeds Pvt. Ltd., a sister concern of NARI's. On evaluating their faecal samples, about 35% of the kids were found to have severe coccidian infection. Adults do not have symptoms but may act as carriers. The oocysts are shed through the faeces which contaminates feed and water. The sporulated oocysts are ingested by young animals and cause an infection in them. The sporulation of coccidia was done in the laboratory to identify the species of *Eimeria*, which were found to be *E. pallida* and *E. granulosa* (Soulsby, 1982) which have moderate pathogenicity. All the affected animals were effectively treated with drugs such as Sulfonamides or Nitrofurazone. Another source of infection could also be drinking water. It was ensured that the water was pre-treated with Sodium Hypochlorite. The diarrhoea was thus controlled after coccidia-specific treatment of affected kids and water treatment to sterilize it.

Project V. Project : Assessing the performance of Leucaena collinsii and comparing its growth and yield with NARI Nirbeeja (KX2)

Funding agency : internally funded

Scientists : Dr. Nandini Nimbkar, Dr. Chanda Nimbkar

Technical staff : Ms. Padmaja Ghalsasi, Ms. Nusrat Patel, Mr. Dattatraya Mulik

A two year trial was carried out to observe the performance and growth of *Leucaena collinsii* in the field. 22 trees of *L. collinsii* grown from seeds and 22 trees of KX2 NARI Nirbeeja propagated by rooting cuttings were planted in Nov 2013 and the resulting trees were first cut in July 2014 when they were eight months old. Both the varieties were cut at 1 m height and their edible biomass measured on electronic weighing scales.

Results

The total wet weight of edible biomass from eight cuttings over two years at a regular interval of 12 weeks was **290 kg** from NARI Nirbeeja (KX2) trees and **200 kg** from *L. collinsii* trees. Yield of *L. collinsii* trees was badly affected due to psyllid damage while KX2 did not appear to have any psyllid damage. KX2 thus gave a 45% higher yield than *L. collinsii*. The dry matter percentage of both varieties was similar at 35-45%. The crude protein percentage of NARI Nirbeeja was, however, higher at 23 to 28% compared to *L. collinsii* at 21 to 26% and the difference approached significance.

KX2 was thus found to be superior in yield, drought resistance and psyllid resistance. In March 2016 when all the trees were under severe water stress due to a long and harsh drought, the yield of KX2 trees was 3.5 times that of *L. collinsii* trees.

I. PUBLICATIONS
(In Alphabetical Order)

Refereed publications :

1. Ghalsasi, P. M., Ghalsasi, P. P., Bandgar, R. S. and Nimbkar, C. 2015. Indications of hypobiosis of *Haemonchus contortus* in goats on the Deccan plateau in Maharashtra. *Indian Journal of Small Ruminants*. 21 (2): 354-355.
2. Nimbkar, C. 2015. Artificial insemination in sheep and goats - an Indian experience. Box 3E5. In The Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture, edited by B.D. Scherf & D. Pilling. FAO Commission on Genetic Resources for Food and Agriculture. Food and Agriculture Organization of the United Nations. Rome. p.323. (available at <http://www.fao.org/3/a-i4787e/index.html>).
3. Nimbkar, C and Ducrocq, V. 2016. Genomic selection in dairy breeding in India – possibility or fantasy. In Proceedings of the 44th Dairy Industry Conference (Make in India: Dairying 2030) held at ICAR-National Dairy Research Institute, Karnal, Haryana, India on 18-20 February 2016.
4. Nimbkar, C. and Ghalsasi, P. M. 2016. Innovative dissemination of small ruminant genetic improvement by a non-government institute in India. Invited Abstract submitted to the American Society of Animal Science Joint Annual Meeting to be held in Utah on 19-23 July 2016.
5. Nimbkar, N., Choudhari, S. and Kanbargi K. 2015. Effect of cutting intervals on yield and nutritive value of *Stylosanthes seabrana*. Abs. No. 1013. Poster presented in International Grassland Congress, New Delhi.
6. Nimbkar, N. and Nimbkar, B. V. 2015. *Cenchrus ciliaris* and *Stylosanthes seabrana* for grassland development in semi-arid areas of Maharashtra. Proceedings of the International Grassland Congress, New Delhi.
7. Singh, V., Nimbkar, Chanda, Khore, C. S. and Nimbkar Nandini. 2015. Development of high fodder-yielding sweet sorghum strain Madhura-2 (NARI-SS-5) for production under monsoon and post-monsoon seasons. Abs. No. 1420. Poster presented in International Grassland Congress, New Delhi.
8. Walkden-Brown S. and Nimbkar, C. 2015. Improved productivity, profitability and sustainability of sheep production in Maharashtra, India, through genetically enhanced prolificacy, growth and parasite resistance (AH/2002/038). In Adoption of ACIAR Project Outputs 2014. Ed. Jilani, A, Pearce, D. and Alford, A. Australian Centre for International Agricultural Research, Canberra, Australia.

Non-refereed publications :

1. Deshpande, M., Singh, Vrijendra and Atre, G. 2016. Bin katyachya kardaiche duheri utpanna, Adhunik Kisan. 5 : 27-29.
2. Deshpande, M., Singh, Vrijendra, Atre, G. and Nimbkar Nandini 2015. Kardai peek vywasthapan, Adhunik Kisan. 4 : 27-28.
3. Deshpande, M., Singh, Vrijendra and Nimbkar Nandini 2015. Kardaiche sankarit navin wan NARI-H-23. Adhunik Kisan. 4 : 29-31.
4. Goat rearing became means of livelihood - story about two goat owners. Case study of two goat keepers Mrs. Vijaya Mandale and Shri Narayan Bhore from village Alkud (M) in District Sangli. 2016. Nimbkar Agricultural Research Institute, Animal Husbandry Division. To be published on the website of the Government of Maharashtra, Department of Agriculture.
5. Nimbkar C. 2016. Necessity of genetic improvement in goats and sheep (shelya-mendhyanmadhye garaj anuvanshik sudharnechi). Agrowon newspaper. 25 January 2016. p. 13.
6. Nimbkar, C. and Ghalsasi, P.M. 2016. Sale price earned by Osmanabadi goat keepers per kg weight. To be submitted to the Indian Journal of Small Ruminants.
7. Nimbkar C. and Pawar B. 2015. New light for rural development - woman adopted a unique path. (gramvikasachi navi pahat - mahilene nivadli vegali vat). Magazine 'Milun Saryajani'. September 2015. pp 36-40.
8. Rajvanshi Anil K. [“The un-swachh truth: Many Indians would rather use the fields than clean a toilet”](#) Published in Huffington Post. 06/04/2015.
9. Rajvanshi Anil K. [“How diesel can be an excellent household fuel for rural areas”](#), Published in Huffington Post. 18/05/2015.
10. Rajvanshi Anil K. [“How you can tell if someone has a great soul ”](#), Published in Huffington Post. 08/06/2015.
11. Rajvanshi Anil K. [“Why fear is the root cause of India’s problem’s ”](#), Published in Huffington Post. 28/08/2015.
12. Rajvanshi Anil K. [“How Gandhiji’s ideas show the path to a sustainable planet ”](#), Published in Huffington Post. 22/09/2015.
13. Rajvanshi Anil K. [“How Pranayama benefits the brain”](#), Published in Huffington Post. 24/09/2015.

14. Rajvanshi Anil K. [“Where has my Lucknow gone?”](#) Published in Huffington Post. 25/10/2015.
15. Rajvanshi Anil K. [“Jawaharlal Nehru as they knew him: A collage of stories”](#), Published in Huffington Post. 14/11/2015.
16. Rajvanshi Anil K. [“Why Indian classics should be taught in our schools”](#), Published in Huffington Post. 27/12/2015
17. Rajvanshi Anil K. [“How technology and spirituality together hold the secret to happiness ”](#), Published in Huffington Post. 28/01/2016.

News :

1. Varsity on a mission to increase sheep population. The Hindu. 13.5.2015.
2. Stories in mass media about renewable energy work : 8.
3. Dr. Anil K. Rajvanshi features on the front page of Mechanical Engineering newsletter (Spring 2015) at University of Florida. The feature story detailed the work being carried out at NARI.

Book chapter :

Singh, V. and Nimbkar, N. 2016. Safflower. P. 147-165. In : Breeding Oilseed Crops for Sustainable Production (Gupta, S. K. ed.) Elsevier.

Reports :

1. Nimbkar, C. June 2015. Annual Report of ‘Osmanabadi Goat Field Unit at NARI’ from 1 April 2014 to 31 March 2015 under the All India Coordinated Research Project (AICRP) on Goat Improvement of the Indian Council of Agricultural Research (ICAR). Submitted to the Director, Central Institute for Research on Goats, Makhdoom, U.P.
2. Nimbkar C. July 2015. Information for Compendium of DBT-funded Completed Projects on the project carried out by NARI-AHD “Increasing profitability of sheep production by genetic improvement using the *FecB* (Booroola) mutation and improved management”.
3. Nimbkar C. April 2015. A proposal for a ‘Capacity Building Programme in livestock and poultry genetic improvement in India’ was prepared and submitted to the Indian Council of Agricultural Research (ICAR) on 13 April 2015 by the Animal Breeding Training Committee appointed by the ICAR for finalizing the ‘Programme for strengthening training of ‘Animal Genetics and Breeding’ in India’. The chairperson of this committee was Dr. Chanda Nimbkar and she was the principal writer of the proposal.

4. Prabhakaran, R. and Singh V. May 2015. Annual progress report of sorghum research under the All India Coordinated Sorghum Improvement Project (AICSIP) of the Indian Council of Agricultural Research (ICAR). Submitted to the Director, Indian Institute of Millets Research, Hyderabad. 50 pp.
5. Singh, V. July 2015. Annual Progress Report of Frontline Demonstrations in Safflower. Submitted to the Indian Institute of Oilseeds Research (IIOR), Hyderabad. 26 pp.
6. Singh, V. August 2015. Annual Progress Report of Safflower research under the All India Coordinated Research Project (AICRP) on Oilseeds of the Indian Council of Agricultural Research (ICAR) for the period 1 August 2014 to 31 July 2015. Submitted to the Indian Institute of Oilseeds Research (IIOR), Hyderabad. 141 pp.

II. INVITED TALKS/LECTURES

1. Dr. Chanda Nimbkar gave presentations on 'Sheep and goat improvement initiatives of NARI' to the Veterinary Officers of the Department of Animal Husbandry, Government of Maharashtra at the Foundation Technical Training Course organised by the State Level Training Centre on 3 and 21 August 2015.
2. Dr. Chanda Nimbkar gave a lecture on 'NARI Suwarna sheep and stall-fed sheep rearing' in the inaugural function of 'Mahatme Mendhi Farm, Training and Research Centre', a stall-fed sheep farm at Rui village in Nagpur district of Maharashtra on 13 March 2016. (Padmashri) Dr. Vikas and Dr. Sunita Mahatme who set up the farm organized the function and Mr. Nitin Gadkari, Minister for Road Transport and Shipping, Government of India was the Chief Guest. Mahatme Farm purchased a NARI Suwarna ram from NARI-AHD in September 2015 and used it to introduce the *FecB* gene into local sheep. They now have a small nucleus of NARI Suwarna sheep. They wish to popularize stall-fed sheep farming based on NARI Suwarna sheep because the grazing areas available for sheep are declining and the children of shepherds cannot get good education because of the family constantly moving around. Stall-fed sheep rearing will provide stability to the lives of shepherd families.
3. Dr. Anil K. Rajvanshi was invited to give a talk at the Times of India-sponsored seminar "Organ donation". The seminar was held on 8 August 2015 at the Kokilaben Ambani Hospital and Medical research institute in Mumbai and was [widely covered in print](#) and TV media.
4. Dr. Anil K. Rajvanshi was invited as the chief guest to Emerson Innovation Centre, Pune on Technology Day (15 September 2015). He gave a talk to 300 + engineers and senior managers entitled "[Innovation for forgotten Indians – How corporate world can improve their lives](#)".
5. Dr. Anil K. Rajvanshi was invited to [give a talk to the students of IIT Kanpur](#) on 26 September 2015. This was a part of Project Saraswati organized by the Alumni Contact Program and Dean of Resources and Alumni (DORA), IIT Kanpur.

6. Dr. Anil K. Rajvanshi gave a talk entitled [“How to live a sustainable life for producing happiness”](#) to Lucknow Management Association, Lucknow, 28 September 2015.
7. Dr. Anil K. Rajvanshi was invited by NATURE (India) to attend the International Conference on Consciousness, organized by NIAS, Bangalore and held from 9-12 December 2015. His article on the conference [was carried by NATURE \(India\) in their newsletter](#).

III. CONFERENCES/SEMINARS/MEETINGS/WORKSHOPS ATTENDED BY STAFF (In Chronological Order)

1. On 7 April 2015, Dr. Chanda Nimbkar attended the meeting of the Monitoring Committee of the ‘Maharashtra Gene Bank Programme’ funded by the Rajeev Gandhi Science and Technology Commission of the Government of Maharashtra. The meeting was presided over by Dr. Anil Kakodkar, the former head of the Atomic Energy Commission.
2. Dr. Radhika Prabhakaran and Ms. Ketaki Kanbargi attended the 45th annual group meeting of All India Coordinated Sorghum Improvement Project (AICSIP) organized by the University of Agricultural Sciences, Raichur, Karnataka from 27-29 April 2015 and presented the progress at NARI centre.
3. Dr. Pradip Ghalsasi, as a member attended the meeting of the ‘Committee for Breeding Policy for Sheep and Goats in Karnataka’ held at Bangalore, Karnataka on 5 May 2015.
4. Dr. Chanda Nimbkar, as a ‘Biological Scientist member, of the ‘Institutional Animal Ethics Committee’ of Vidya Pratishthan’s School of Biotechnology, Baramati attended the IAEC meeting held on 18 August 2015.
5. Dr. Vrijendra Singh, Dr. R. R. Jadhav, Mr. R. V. Kale and Mr. G. E. Atre attended the Annual Group Meeting of Safflower and Linseed of the All India Coordinated Research Project (AICRP) on Oilseeds organized by the College of Agriculture, Indore from 27-29 August 2015 and presented the annual progress report of safflower research at NARI.
6. Dr. Chanda Nimbkar attended the Annual Review Meeting of the All India Coordinated Research Project (AICRP) on Goat Improvement organised by the Central Institute for Research on Goats (CIRG) at Makhdoom, U.P. on 7-8 September 2015 and presented the annual progress report of the Osmanabadi Field Unit of NARI.
7. On 17 October 2015, Dr. Chanda Nimbkar attended the inaugural function of the new building of the Agricultural Development Trust’s College of Agriculture and Allied Sciences at Sharadanagar, Tal. Baramati. Shri Arun Jaitley, Minister of Finance, Corporate Affairs, Information and Broadcasting, Govt. of India was the Chief Guest.
8. Dr. Chanda Nimbkar attended the 44th meeting of the Board of Trustees of the International Livestock Research Institute (ILRI) as an ‘Observer’, on an invitation by the Board, with a view to nominating her as a member. The meeting was held at Washington D.C., U.S.A. on

- 31 October to 4 November 2015. She was invited to talk briefly about her work area, background and experience.
9. Dr. Chanda Nimbkar attended the Marwar Camel Culture Festival organised by the Lokhit Pashu-Palak Sansthan at Sadri near Udaipur, Rajasthan on 7 November 2015. She facilitated a debate between camel breeders and Rajasthan government officials about necessary action to save the camel and finding solutions to the ongoing camel population decrease.
 10. On 22 November 2015, Dr. Chanda Nimbkar and Dr. Pradip Ghalsasi had a meeting in Pune with Prof. John Gibson of the University of New England, Australia and Mr. Donald Nkrumah, a Senior Officer of the Bill and Melinda Gates Foundation, U.S.A. They had discussions about implementation of a proposed goat development project in Bihar and NARI's potential technical support for this project.
 11. Dr. Nandini Nimbkar attended the XXII International Grassland Congress –IGC 2015 held in New Delhi from November 20-24, 2015. She gave one oral and two poster presentations.
 12. Dr. Anil K. Rajvanshi was invited by Nature (India) to attend the International Conference on Consciousness organized by NIAS, Bangalore and held from 9-12 December 2015. His article on the conference was carried by Nature (India) in their newsletter.
 13. On 18-20 February 2016, Dr. Chanda Nimbkar participated in the 44th Dairy Industry Conference organized by the Indian Dairy Association, North Zone and by the ICAR-National Dairy Research Institute at Karnal, Haryana, India. She presented a paper 'Genomic selection in dairy breeding in India – Possibility or Fantasy' in the session **Selecting animals for genes: Revisiting the breeding policy, towards genomic selection.** She had been selected by the organizing committee to be the 'Mentor' of this session and determined the topics of the papers to be presented and chose the speakers.
 14. Dr. Chanda Nimbkar attended the inaugural function of a stall-fed sheep farm 'Mahatme Mendhi Farm (Training and Research Centre)' at village Rui in Nagpur district on 13 March 2016. She was one of the invited speakers. This farm, established by Dr. Sunita and Dr. Vikas Mahatme (M.P., Rajya Sabha), will popularize and disseminate in Nagpur and other districts of Eastern Maharashtra, the technology of rearing prolific NARI-Suwarna sheep developed by NARI.

IV. TRAINING AND EXTENSION ACTIVITIES

- **Training :**

1. Shri Jeevan Balasaheb Pawar from Wathar Kiroli, Tal. Koregaon, Dist. Satara was given hands-on training in goat and sheep rearing while working at Dhuldeo farm on 4 to 17 August 2015. Eleven educational booklets on goat management published by AHD were given to him free of cost.

- During the year AHD conducted the following training courses.

Sr. No.	Date	Subject	Participants
1.	7-10 April 2015	Advanced methods of sheep breeding and A.I. in goats.	Seventeen veterinary officers from Tumkur and Chikmagalur districts deputed by the Department of Animal Husbandry and Veterinary Services of Government of Karnataka.
2.	24 April 2015	Vegetative propagation of NARI Nirbeeja subabhoole.	Shri Venkatesh H Chabbi, Karnataka
3.	17-20 June 2015	Artificial insemination in goats.	Four officers working with Noor Group (Noor Herawi General Trading LLC) in Herat, Afghanistan under 'Cashmere Goat Development' project of Colorado State University, USA. 1. Mr. Ahmad Rooin Radmehr 2. Mr. Mohammad Kabir Akbari 3. Ms. Roya Ansari 4. Mr. Esmatullah Haidari Mr. Mojtaba Noor of Noor Group accompanied them.
4.	8 August 2015	Advanced methods of sheep management.	1. Dr. B. Hemant Kumar, Veterinary Doctor, Dept. of Animal Husbandry, Govt of Andhra Pradesh 2. Mr. R. Praveen, Scientist (Horti.), Acharya N. G. Ranga Agricultural University, Srikakulam, AP 3. Shri Ramana (Progressive farmer), Srikakulam, AP
5.	12 August 2015	Vegetative propagation of NARI Nirbeeja subabhoole by grafting and rooting.	Dr. B.R. Athani and Dr. Aira with two others from Future Greens Samsthe, Gramachetana Souharada Producers Coop, Navanagar, Bagalkot, Karnataka.
6.	14 October 2015	Advanced methods of sheep production.	Twenty five farmers from Telangana state deputed by TSMILD, Animal Husbandry Department of Telangana. The Joint Director and Assistant Director of TSMILD accompanied them.
7.	16-22 January 2016	Improved goat management and artificial insemination.	Five staff members including the Principal Investigator and Senior Research fellow of ICAR-All India Coordinated Research Project on Goat Improvement – Changthangi Goat Unit in Leh, Ladakh.
8.	22 January 2016	Improved methods of sheep management	Thirty eight farmers and five officers from Karimnagar district deputed by the Animal

			Husbandry Department of Telangana Government.
9.	29 March to 1 April 2016	Basics of goat management and artificial insemination	Mr. Nikhil Ratnam, the Managing Director of Quidditas Farms Pvt. Ltd., Gulberga, Karnataka, Dr. Heidi, their Consultant Veterinarian from U.S.A. and Head, Dairy Unit of Quidditas Farms.



Trainee from Ladakh castrating a lamb



Trainee from USA, Dr. Heidi Hart learning intricacies of goat AI at NARI-AHD

• **Extension activities :**

Dissemination of animals :

Sr. No.	Date	Name of the person	No. of animals supplied			
			Rams		Ewes	
			<i>FecB^{BB}</i>	<i>FecB^{B+}</i>	<i>FecB^{BB}</i>	<i>FecB^{B+}</i>
1.	10 April 2015	The Deputy Director, AH & VS, Chikmagalur, Karnataka	0	10	0	2
2.	22 April 2015	The Deputy Director, AH & VS, Tumkur, Karnataka	50	10	0	0
3.	27 April 2015	Mr. C.M. Munivenkatappa, Kolar, Karnataka	3	3	5	3
4.	9 May 2015	Mr. Satish G. K., SSS Express, Secunderabad, Andhra Pradesh	1	0	0	0
5.	9 June 2015	Agricultural Development Trust, Baramati, Dist. Pune, Maharashtra	1	0	0	0
6.	10 June 2015	Kisan Shripati Dhekale, Phaltan, Maharashtra	1	0	18	9
7.	7 August 2015	Senior Farm Superintendent, ZARS, VC Farm, Mandya, Karnataka	0	0	11	15
8.	12 September 2015	Shri Laxman Maruti Khatal, Choubhe Pimpri, Dist. Solapur, Maharashtra	1	0	3	0

9.	12 September 2015	Dr. Sunita Mahatme, Mahatme Mendhi Farm, Nagpur, Maharashtra	1	0	0	0
10.	8 October 2015	Mr. Vikas Kisan Dhekale, Phaltan, Maharashtra	16	24	6	4
11	8 March 2016	Asst. Director, Dept. of AH & VS, Tumkur, Karnataka	34	6	0	0
12.	8 March 2016	Mr. Sartaj Ahmed, Sira, Dist. Tumkur, Karnataka	0	0	1	0
13.	20 March 2016	Dept. of Veterinary Gynaecology & Obstetrics, Veterinary College, KVAFSU, Hebbal, Bangalore, Karnataka	0	5	11	32
14.	22 March 2016	Shri M. Maheshwara Rao, Tirumalagiri Village, Dist. Nalgonda, Telangana	0	2	7	3
Total			108	60	62	68

Dissemination of seeds and other products

The following products were disseminated to farmers and for research purposes during the past year.

Sr. No.	Safflower seed	Quantity (Kg)
1.	NARI-57	647
2.	NARI-6	118
3.	NARI-H-23	100
4.	NARI-38	69
5.	NARI-NH-1	28
6.	D-152-12-43 (Parent of NARI-H-23)	4
7.	Others	4
	Total	970

Sr. No.	Sweet sorghum seed	Quantity (Kg)
1.	Madhura-2 [(D-94)74]	38
2.	Madhura	27
3.	Experimental varieties, hybrids and their parents	19
4.	D (102-12)	30
5.	NARILC-07-05	18
6.	SSV-84	14
7.	Madhura-3 [(D-118)34]	1
	Total	147

Safflower petal herbal tea	22 Kg
Madhura sweet sorghum syrup	388 Kg
Pads of <i>Nopalea cochinellifera</i> (Cactus)	150 Kg
<i>Stylosanthes seabrana</i> seed	150 Kg
<i>Cenchrus ciliaris</i> seed	15 Kg

V. TRAINING RECEIVED BY NARI STAFF

1. On 16-17 June 2015, Ms. Padmaja Ghalsasi visited M/s J. K. Paper Ltd., Fort Songadh, near Surat in Gujarat along with Mr. Vitthal Bhoite of Nimbkar Seeds Pvt. Ltd. for training in 'Propagation of KX2' imparted by Mr. Surendra Narkhede of J.K. Paper Ltd. They learnt the protocol followed by Mr. Narkhede to propagate KX2 by rooting of cuttings on a large scale in the polyhouse. They also learnt about planting and maintenance of mother plants in a controlled environment. During this training they also observed routine work carried out in the nursery of J. K. Papers. NARI-AHD had supplied 15 NARI Nirbeeja plants to M/s. J. K. Papers 3 years ago from which they have produced over 20,000 clones already.
2. On 1-5 March 2016, Ms. Bharati Pawar, Assistant Director, NARI-AHD and Mr. Sachin Kakade working under the ICAR-All India Co-ordinated Research Project – Osmanabadi Goat Field Unit at NARI attended the training programme 'Data recording, record keeping and analysis of Goat Production System' organised by AICRP Project Co-ordinator Unit at Central Institute for Research on Goats, Farah, Mathura, U.P. This training programme was found to be extremely useful and the Osmanabadi Unit has benefited from the higher level of awareness of these two staff members after the training.

VI. VISITS BY STAFF TO OTHER INSTITUTES

1. Dr. Chanda Nimbkar visited Sri Lanka on 10-15 May 2015 for evaluation of the work in Genetic Resources of the Food and Agriculture Organization (FAO), United Nations, Rome, Italy. Her assignment was to evaluate the Dairy Cattle and Buffalo Improvement Project carried out in Sri Lanka in 2010-11 with funding from the FAO.

During this visit she visited the University of Peradeniya and gave a lecture on 'Sheep and goat improvement initiatives at NARI' to students of the Department of Animal Science.

2. Mr. Rupesh Khanvilkar, Farm Manager of AHD visited sheep farm of Shri Mahesh Sarjerao Tule at village Kedgaon, Tal. Daund, Dist. Pune on 12 June 2015. He inspected NARI Suwarna sheep supplied by AHD to him and saw Osmanabadi, Swojat and Boer goats on the farm.
3. Dr. Chanda Nimbkar and Mr. Kanhaiya Chavan visited Shahajiraje Foundation at village Kuchi, Tal. Kavathemahankal, Dist. Sangli on 1 July 2015. Staff members of the Foundation showed them outstanding Osmanabadi goats and sheep flocks in Kuchi village.
4. Dr. Chanda Nimbkar visited Chitale Dairy at Bhilwadi Station in Sangli District on 2 July 2015 to see their buffalo dairy farm. Mr. Vishwas Chitale showed her around and gave information about their project.
5. Dr. Chanda Nimbkar visited Nepal from 29 September to 4 October 2015 on a work assignment of the FAO for evaluation of the Goat Breeding Program in Nepal under the

Agriculture and Food security Project (AFSP) funded by the World Bank and also for evaluating the Dairy Cattle Improvement Project funded by the FAO.

6. Dr. Chanda Nimbkar visited the Malegaon Livestock Fair near Nanded in Maharashtra together with Dr. Ilse Koeher-Rollefson of LPPS, Rajasthan and Mr. Sajal Kulkarni of BAIF on 12 January 2016 to see Lal Kandhari cattle and Osmanabadi goats. They also visited some rural areas in the vicinity.
7. Mr. Rupesh Khanvilkar visited sheep farm of Mr. Vikas Dhekale at Baramati on 30 January 2016. He inspected NARI Suwarna sheep supplied by AHD in his flock.

VII. VISITORS TO THE INSTITUTE

1. Visits by individuals during the year to see research and development activities of NARI

Sr. No.	Date	Visitor's name	Visitor's organization or place	Purpose of visit
1.	3 April 2015	Dr. Balaji Jadhav (Board Director), Mr. R. Sarat Babu Senior Manager P&I) + board members	Sangam Milk Producer Company, Vadlamudi, Guntur Dist., Andhra Pradesh	To get information about goat and sheep research and the use of 'Madhura' sweet sorghum as a fodder crop and for ethanol and syrup production.
2.	9 April 2015	Mr. M. G. Gogate Mr. B. V. Nimbkar and Dr. Chanda Nimbkar	Consultant, agroforestry Founder, NARI Director, A. H. Division, NARI	A meeting to discuss the report prepared by Mr. Gogate about his consultancy visit to J. K. Paper Ltd., Fort Songadh regarding <i>Leucaena</i> plantations for paper production.
3.	10 April 2015	Mr. Sanjeevraje Naik Nimbalkar, Chairman and Member	Govind Milk and Milk Products and Satara Zilla Parishad respectively.	To hand out certificates to trainees from the Department of Animal husbandry and Veterinary Services, Government of Karnataka who attended a training course in Advanced goat and sheep management at NARI-AHD.
4.	20 April 2015	Mr. Zaffar-ulha Khan	National Council for Urban and Rural Development Society, Jammu, Jammu and Kashmir.	To get information about Boer goats for cross-breeding with local goats in Jammu.
5.	23 April 2015	Mr. Mahesh N. Ghorpade	Vedant Agritech, Pune	To give information about silicon fertilizers and their application to field crops.
6.	24 April 2015	Mr. N. A. Kumbhar	Taradgaon, Tal. Phaltan	For weather data collection.
7.	27 April 2015	Mr. Sharad Zanjurne	Nirgudi, Tal. Phaltan	For advice regarding how to kill a tree growing in his well.
8.	29 April 2015	Dr. K. E. Sasturkar	Phaltan	To get information about <i>Opuntia</i> .
9.	30 April 2015	Mr. Veerdhaval Jadhav	Piliv, Tal. Malshiras, Dist. Solapur	To get information about <i>Opuntia</i> .
10.	4 May 2015	Mr. Kishorkumar Deshmukh	Sangli	To get information about <i>Opuntia</i> .
11.	4 May 2015	Mr. Ratan M. Patil,	Tambave	To get information about <i>Opuntia</i> .

		Mr. Suhas Bhosale		
12.	5 May 2015	Mr. Rajeev Prabhu	Ycub Tech., Mumbai	To discuss about conducting trials of H110R (water evaporation retardant) on sugarcane and rice.
13.	8 May 2015	Mr. Winson Kunnath	Diana food, Pune	For information about safflower flowers.
14.	13 May 2015	Mr. Balbir Singh	Pune	To acquire a unit of solar water purification system for installation in his village.
15.	15 May 2015	Dr. B. Ekambaram, Principal Scientist and Head	Livestock Research Station, S.V. Veterinary University, Palamaner, Andhra Pradesh.	To see and obtain information about NARI. Suwarna and NARI Composite sheep for introgression of the FecB gene in local sheep of Andhra Pradesh.
16.	26 May 2015	Mr. Raju Gupta	IIT, Patna	To learn about the research being conducted at NARI .
17.	29 May 2015	Mr. Sagar Patil	At Post. Jalgaon	To see the institute.
18.	13 June 2015	Mr. Pramod K. Honwar	Sangli	To get information about <i>Opuntia</i> .
19.	12-15 June 2015	Dr. John Copland	Former Research Project Coordinator, Australian Centre for International Agricultural Research, Canberra, Australia	To obtain an update on the activities of NARI-AHD and to meet everyone at NARI-AHD.
20.	23 June 2015	Mr. Vipin Kothari Mr. Bhushan Pawar Ms. Anjali Jain Mr. Nilesh Tapas Mr. Ramesh Verma	Sr. Manager, Mahindra & Mahindra, Hyderabad Mahindra & Mahindra, Pune Tech. Mahindra, Chandigarh Pune Punjab Agricultural Univ., Ludhiana	To discuss about the conservation tillage trial to be conducted at Phaltan.
21.	26 June 2015	Dr. S. S. Roy (Research Coordinator) Dr. V. K. Kauthale (Research guide for Env. Sci.) Mr. Sagar Kadao (Entomology) Mr. Ashok	Bharatiya Agro Industries Foundation, Pune	To discuss about the <i>Opuntia</i> project carried out at NARI and take planting material of accessions in our collection.
22.	27 June 2015	Mr. Bhushan Pawar	Mahindra & Mahindra, Pune	To discuss about the trial to be conducted.

		Mr. Imran Khan		
23.	1 July 2015	Mr. Shashank Khokher Mr. Nilesh Tapas Mr. Bhushan Pawar	Mahindra & Mahindra, Pune	To discuss about the trial to be conducted.
24.	5 July 2015	Ms. Anjali Jain Mr. Bhushan Pawar	Mahindra & Mahindra, Pune	To discuss about the trial to be conducted.
25.	7 July 2015	Mr. Santosh A Dalvi	Satara	To get information about <i>Opuntia</i> .
26.	7 July 2015	Mr. Vaibhav V. Jagdale	Karad	To get information about <i>Opuntia</i> .
27.	24 July 2015	Mr. Vijayendra Kamble	Natepute, Dist. Solapur	To get information on spent wash detoxification.
28.	4 August 2015	Mr. Vishwas Bhosale, (IAS), Commissioner	Animal Husbandry, Maharashtra State, Pune, Maharashtra.	To familiarize himself with the research and development activities of AHD.
29.	5 August 2015	Mr. Sagar M. Keskar	College of Engineering, Phaltan	For weather data collection.
30.	5 August 2015	Mr. Somabhai Patel	Ahmedabad	To discuss regarding taking up safflower seed production in Gujarat.
31.	7 August 2015	Mr. Bhushan Pawar	Mahindra & Mahindra, Pune	To discuss about the maize trial underway at NARI.
32.	8 August 2015	Mr. Rajkumar Kamble	Zilla Prashikshan Kendra, Solapur Dist., Maharashtra.	To get information about goat rearing with improved breeds as a business opportunity for farmers.
33.	12 August 2015	Ms. Prachi Pathak and Ms. Varsha Mahajan	Pune	To get information about safflower flowers and sweet sorghum syrup production.
34.	14 August 2015	Dr. Sonali Shinde Ms. Preeti Bhoite + 1 Ms. Radhika Deshmukh + 1	Gram Gaurav Pratisthan, Pune The Enchanted Gardens, Pune	To get information about the activities of the institute.
35.	17, 18, 19, 20 and 21 August 2015	Ms. Divya Bhosale Mr. Tanmay Kumbhar Ms. Alfia Metkari Ms. Swaliha Sheikh Mr. Tejas Gunjal	Eighth standard students of Kamala Nimbkar Bal Bhavan, Phaltan	Work experience.
36.	18 August 2015	Prof. Shashikant Shinde and Mr. Rahul Govekar	Y. C. College, Satara	To discuss regarding how to carry out sustainable development of rural areas.

37.	22 August 2015	Mr. Sreejith Moolayil, COO and Ishan Gupta, Co-founder	Healthy World Wellness Solutions Pvt. Ltd., Pune	To discuss the modalities of on-line marketing of sweet sorghum syrup as molasses and safflower flowers as herbal tea.
38.	22 August 2015	Mr. Abhijeet Pawar	Phaltan	For collection of rainfall data.
39.	25 August 2015	Mr. Umesh Kulkarni	Pune	To explore the possibility of marketing sugarcane syrup and jaggery produced at NARI.
40.	29 August 2015	Mr. Bhushan Pawar	Mahindra & Mahindra, Pune	To see the maize trial underway at NARI.
41.	1 September 2015	Mr. Bhushan Pawar Mr. Harish Chavan, COO, Farm Division	Mahindra & Mahindra, Mumbai	To discuss the collaborative project underway at NARI.
42.	2 September 2015	Mr. Dhuldev S. Kokare + 3	Bharati Vidyapeeth's College of Engineering, Kolhapur	To discuss topics for research projects in thermal sciences.
43.	4 September 2015	Mr. Vijay Gofane and Mr. Mahesh Rite	Kolki, Phaltan	To see the electric rickshaw.
44.	9 September 2015	Mr. Abbas Tafida	Jalingo, Nigeria.	Dr. Pradip Ghalsasi gave information about AHD's research and development work in sheep and goats.
45.	12 September 2015	Ms. Madhura Rajvanshi (teacher) + 19 eighth standard students	Kamala Nimbkar Bal Bhavan, Phaltan	For interaction on the topic of solar energy.
46.	15 September 2015	Mr. Shrikant Gaikwad	K. B. Export, Sastewadi	For weather data collection.
47.	16 September 2015	Mr. Pralhad V. Choudhari + 1 person	Jalgaon	To get information on fodder species for feeding goats.
48.	19 September 2015	Mr. M. Mohanan Vice-president and business head, Mr. Vipin Kothari Mr. Bhushan Pawar	Mahindra Applitrac, Mohali, Punjab Mahindra & Mahindra Hyderabad Mahindra & Mahindra, Pune	To see the maize field trial and discuss its progress. Brain-storming to solve the problems and plan the future programme.
49.	3 October 2015	Mr. Mandar Kulkarni, Chairman	Ideal Gas Springs Pvt. Ltd., Satara	To know about NARI's activities and explore the possibility of NARI's participation in the

		Mr. Dnyanesh Palekar, Director (Business Development) Mr. Sumedh Pethkar Mr. Rajesh Korpe, Director	Palekar Food Products Ltd., Satara Mechanite Engineering Solutions, Satara Spark Autometal Comp. Pvt. Ltd., Satara	proposed industrial exhibition.
50.	5 October 2015	Dr. V. H. Ashvathama, Physiologist Dr. S. Ravi Kumar, Agronomist	AICSIP, Bijapur, Karnataka Indian Institute of Millets Research, Hyderabad	For monitoring AICSIP coordinated trials.
51.	13 October 2015	Mr. Anil R. Kharat + 1 person	Dahiwadi, Tal. Man	To find out about the safflower and sweet sorghum research being carried out at NARI.
52.	13 October 2015	Mr. Sunil N. Yadav + 1 person	Lonand, Tal. Khandala	To get information about Madhura sweet sorghum.
53.	15 October 2015	Mr. Bhushan Pawar	Mahindra & Mahindra, Pune	To see the maize trial underway at NARI.
54.	18 October 2015	Veterinary Officers 1. Dr. R.M. Kadam 2. Dr. Raju B. Metri 3. Dr. S.B. Mokashi	Government Veterinary Dispensaries at Yamakanmaradi, Kesti and Daddiin Belgaum District of Karnataka.	To see and get information about Boer goats. They purchased 30 semen straws of Boer bucks personally to introduce the Boer breed in their working area through insemination of local goats.
55.	21 October 2015	Dr. Narendra Kadoo Dr. Ashwini Rajwade Ms. Neha Jamdade	National Chemical Laboratoy, Pune	For sowing of trials under NASF project of safflower.
56.	24 October 2015	Mr. P. S. Patil	Kalaj, Tal. Phaltan	To get information about 'Madhura' syrup and organic jaggery.
57.	27 October 2015	Mr. Vinod Jain	Jackson Inns, Phaltan	To discuss about how rural restaurant concept can be implemented by the Jackson Inns.
58.	31 October 2015	1. Mr. Teus Korevaar 2. Mr. Prekash Ramsingh	1. AERES Agricultural Education 2. Lentiz Education Group The Netherlands respectively.	Dr. Pradip Ghalsasi gave information about AHD's research and development activities in sheep and goats and showed around the farm and laboratories.

59.	4 November 2015	Mr. Nanaso K. Taware + 1 person	Sangavi, Tal. Baramati	Wanted to find out if safflower can be a suitable crop to grow under conditions of severe water shortage.
60.	7 November 2015	Mr. Bhushan Pawar	Mahindra & Mahindra, Pune	To see the maize trial and discuss the harvesting procedure.
61.	13 November 2015	Mr. Mukul K. Joshi + 2 persons	Pune	To see the research work being carried out at NARI.
62.	26 November 2015	Mr. Shirishkumar M. Shinde	Tambave, Tal. Lonand	To get information on safflower.
63.	30 November 2015	Dr. Narendra Kadoo Dr. Ashwini Rajwade Ms. Neha Jamdade	National Chemical Laboratory, Pune	For sowing of EMS-treated seed for NASF project on safflower.
64.	5 December 2015	Ms. Priya Yadav Ms. Ekta Shukla Ms. Ovee Yadav	National Chemical Lab., Pune National Chemical Lab., Pune Gurukul School, Pune	To discuss CSIR 800 programme for incubating science and technologies in the villages of India.
65.	15 December 2015	Shri. Madhav Gogate (Agroforestry Consultant) Mr. Umeshkumar Agrawal, (Managing Director, MSFC) Mr. Bhosale, (Local incharge, MSFC) Mr. Milind Kakde (Honeybee expert) + 7 persons from NARI	Pune Maharashtra State Farming Corporation, Pune Maharashtra State Farming Corporation, Phaltan Phaltan	Mr. Gogate gave a presentation on his visit to Israel (which was sponsored by NARI) to study nectariferous <i>Eucalyptus</i> species and their use in bee keeping. It was followed by a discussion on this topic. They also visited AHD to get information about improved goat farming and varieties of fodder for goats.
66.	16 December 2015	Mr. Satish Suryavanshi Mr. Nilish Jaware Mr. Kamlesh Chavan	Nashik	To get information about gasifier research at NARI.
67.	19 December 2015	Mr. Pravin Bhagwat	Pune	To find out how he can contribute to spreading NARI's work.
68.	22 December 2015	Dr. Ashwini Rajwade Ms. Neha Jamdade Ms. Gayatri Salunkhe	National Chemical Laboratory, Pune	To collect tissue samples from safflower plants grown under NASF project.

		Mr. Kiran Dhoble		
69.	24 December 2015	Mr. Vinod Jain	Jackson Inns, Phaltan	To discuss about how rural restaurant concept can be implemented by the Jackson Inns.
70.	25 December 2015	Dr. Nadeem Fairoz Mr. Subhaskar Reddy + 2 persons	Bangalore	To see the fodder crops and the male buffaloes kept in the <i>Leucaena-Cenchrus</i> pasture.
71.	29 December 2015	Mr. Ram Kalapahad Mr. Govind Labshetwar	Vidya Pratishthan's College of Engineering, Baramati	For getting information about the wind mill.
72.	31 December 2015	Mr. Milind Shah + 1	Solapur	For getting information on the solar water purifier.
73.	31 December 2015	Mr. Shailendra Agarwal Anurag Gupta	Veena Industries, Pune	To explore the possibility of lanstove manufacturing on large scale.
74.	5 January 2016	Dr. R. D. Prasad (Plant Pathology) Dr. S. B. Ghuge (Plant Breeding) Dr. P. C. Uke (Agronomy) Dr. A. V. Akashe (Entomology)	Indian Institute of Oilseeds Research, Hyderabad Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola Mahatma Phule Krishi Vidyapeeth, Rahuri	Monitoring of AICRP trials on safflower.
75.	7 January 2016	Miss. Rutuja Kale	Dhaval, Tal. Phaltan	To discuss the topics on which project work can be carried out.
76.	7 January 2016	Dr. M. Y. Samdur, Principal Scientist (Plant Breeding) Dr. A. Kalaisekar, Senior Scientist (Agri. Biotechnology)	Indian Institute of Millets Research Center on Rabi Sorghum, Solapur Indian Institute of Millets Research, Hyderabad	Monitoring of AICSIP trials on sorghum.
77.	7 January 2016	Miss. Rutuja Kale	Dhaval, Tal. Phaltan	To finalize the research topic for project work.
78.	9 January 2016	Shri Kakasaheb Bargal, Editor (Development) and a delegate Mr. Zvi Matalon from Israel	Agrowon, Pune, Maharashtra and Head, Livestock Division JETHRO, Israel respectively.	To get information about technologies developed by NARI which can be used in their 'Smart Village' programme.

79.	12 January 2016	Mr. S. A. Bagi Mr. D. D. Patil	D. S. Associates, Baramati	To get information on gasifier project.
80.	12 January 2016	Mr. Mohan Pusalkar + 3	Pune	To get information about the research work being conducted at NARI.
81.	13 January 2016	Mr. Dasale Manohar Reddy, MLA	Peddapally, Karimnagar Dist., Andhra Pradesh.	To get information about NARI Suwarna sheep and Boer goats.
82.	16 January 2016	Dr. Narendra Kadoo and his 3 team members	National Chemical Laboratory, Pune	For collecting leaf samples of safflower plants in trials of NASF project.
83.	19 January 2016	Mr. M. A. Javali Mr. Sudhir Vahal	Thermax Ltd., Pune	To discuss about areas of collaboration between Thermax and NARI.
84.	21 January 2016	Dr. Narendra Kadoo, Dr. Ashwini Rajwade + 4	National Chemical Laboratory, Pune	For recording observations on NASF safflower-trials.
85.	3 February 2016	Dr. Ashwini Rajwade + team	National Chemical Laboratory, Pune	Collection of samples from safflower plants of NASF project.
86.	4 February 2016	Mr. Shivprasad Shukla + 1	IVRCL, Pune	To see the lanstove and other products developed by NARI.
87.	17 February 2016	Dr. M. V. Hegde Dr. P. B. Ghorpade Dr. Santosh Dr. Vidya Gupta Dr. Narendra Kadoo Dr. Ashwini Rajwade Ms. Neha Jamdade Ms. Gayatri Salunkhe	Bharati Vidyapeeth University, Pune -”- -”- National Chemical Laboratory, Pune -”- -”- -”-	To attend the progress meeting of NASF project on safflower.
88.	19 February 2016	Mr. Suhas Shrikhande and Mr. Ganesh Ghanwat	Phaltan	To see the plots of <i>Stylosanthes seabrana</i> and ‘Wondergraze’ <i>Leucaena</i> .
89.	20 February 2016	Dr. S. K. S. Chauhan	J. K. Paper Ltd., Fort Songadh, Gujarat	To try and solve the problems at NARI in rooting of ‘NARI Nirbeeja’ <i>Leucaena</i> cuttings.
90.	22 February	Mr. Kisan Pawar + 2	Akluj	To get information on safflower flowers.

	2016			
91.	7 March 2016	Dr. Jimmy Smith, Director General, Mrs. Charmaine Smith and Mr. Alok Jha of ILRI, India	International Livestock Research Institute (ILRI), Nairobi, Kenya.	To learn about the activities of NARI-AHD.
92.	8 March 2016	Mr. Saurabh Shahane and Mrs. Prajakta Shahane	Chicago, U.S.A.	Were inspired to do something for India after reading about NARI's work and came to find out more.
93.	11 March 2016	Mr. Bipin Ghodke + 1 person	Beed	Came to find out if they can manufacture 'Madhura' syrup.
94.	22 March 2016	Dr. J. N. Daniel, Programme Advisor Dr. S. S. Roy, Research Coordinator, Dr. V. K. Kauthale Research guide for environmental science, Mr. Sagar Kadao	BAIF Development Research Foundation, Pune	To get information about NARI's research project on <i>Prosopis</i> and to collect seeds and cuttings from germplasm at NARI.



Dr. Chanda Nimbkar showing FecB carrier ewes with their twin lambs to Dr. Jimmy Smith, Director General, International Livestock Research Institute, Nairobi, Kenya and Mrs. Charmaine Smith at NARI-AHD

2A. Visits by groups during the year to see research and development activities of NARI

Sr. No.	Date	No. of persons	Type of group	Organized by
1.	3 March 2016	Dr. M. B. Kanade + 12 students	T.Y. BSc. (Botany) students	Tuljaram Chaturchand College, Baramati
2.	11 March 2016	Prof. Sonali Saste and Prof. S. V. Burungale + 9 students from Afghanistan	Persons working in various agriculture-related agencies in Afghanistan wanted to get practical knowledge of safflower breeding	ADT's College of Agriculture, Baramati

2B. Visits by groups during the year to see research and development activities in goat and sheep development of AHD

Sr. No.	Date	No. of persons	Type of group	Organized by
1.	15 April 2015	8	Farmers and three staff members	Bharatiya Lok Va Paryavaran Vikas Sanstha, Aurangabad, Maharashtra
2.	18 May 2015	25	Farmers with two officers	Block Development Officer, Panchayat Samiti, Baramati, Dist. Pune, Maharashtra
3.	26 May 2015	25	Farmers from Rangareddy District	Dr. Ch. Ramesh, Deputy Director Animal Husbandry, Govt. of Telangana, Hyderabad, Telangana
4.	6 June 2015	55	Trainees	Maharashtra Goat Development Academy, Lonand, Tal. Khandala, Dist. Satara, Maharashtra
5.	23 June 2015	22	Students and trainees	Lokmangal Agricultural College and Agri Clinic Agri Business Training Centre of Shriram Pratishthan Mandal, Wadala, Tal. North Solapur, Dist. Solapur, Maharashtra
6.	23 June 2015	10	Farmers	Panchayat Samiti Veterinary Dispensary, Renapur, Dist. Latur, Maharashtra
7.	15 July 2015	12	Trainees	Krishi Vigyan Kendra, Shardanagar, Tal. Baramati, Dist. Pune, Maharashtra
8.	16 July 2015	13	Trainees	Agri Clinic Agri Business Training Centre of Shriram Gramin Sanshodhan Va Vikas Pratishthan, Osmanabad, Maharashtra
9.	23 July 2015	9	Trainees	Maharashtra Centre for Entrepreneurship Development, Satara, Maharashtra
10.	24 August 2015	200	School students (5 th to	Shrimansheth Dhanyakumar Ratanchanda Gandhi Vidyalaya,

			8 th Std.)	Dhuldeo, Tal. Phaltan, Dist. Satara, Maharashtra
11.	27 August 2015	8	Social workers	Shri Rambhau Mane, Chairman, Bhatke Vimukta Jati va Adivasi Dyanpeeth with seven colleagues.
12.	3 September 2015	30	Farmers with one officer	O/o Assistant Commissioner, Animal Husbandry, Jalna, Dist. Jalna
13.	8 September 2015	150	Students	Zillha Parishad schools at Wadjal, Dhembre Mala and Nimbhore villages in Phaltan taluka.
14.	14 October 2015	7	Farmers	Jankalyan Swayamsahayata Shetkari Gat, Dhoroshi, Tal. Patan, Dist. Satara
15.	1 December 2015	6	Faculties	Pracharya Swa. Ishwar Deshmukh Pashudhan Vyavasthapan Va Dugdhotpadan Padvika Vidyalaya, Digras, Dist. Yawatmal
16.	14 December 2015	40	Farmers	Taluka Agriculture Office, Malshiras, Dist. Solapur
17.	22 December 2015	14	Farmers	Farmers from 5 villages of Koregaon Taluka in Dist. Satara.
18.	23 December 2015	23	Staff and students	Gramonnati Mandal Livestock Management Diploma School, Narayangaon, Dist. Pune
19.	29 December 2015	30	Principal and students	Agri Polyclinic Institute, Shirala, Dist. Sangli
20.	11 January 2016	14	Staff members and volunteers	Vibhavari NGO, Bawadiya, Dist. Dewas, Madhya Pradesh
21.	12 January 2016	10	Assistant Commissioner	District Animal Husbandry, Sangli, Dist. Sangli
22.	4 February 2016	30	Students	Padmabhushan Dr. Sukhatme Agricultural Polytechnic Institute, Phaltan, Dist. Satara
23.	4 February 2016	35	Farmers	Dept. of Animal Husbandry and Veterinary Services, Belgaum, Karnataka
24.	8 to 15 February 2016	415 (in 7 batches)	Women SHG members and farmers	Ekta Gramin Vikas Pratishthan, Pune (visitors from different villages of Purandar taluka)
25.	29 February 2016	11	Farmers	Block Development Officer, Panchayat Samiti, Digras, Dist. Yawatmal
26.	14 March 2016	50	Farmers	AEL, AEEC, UAS Dharwad, Karnataka
27.	26 March 2016	23	Village women	Mahila Arthik Vikas Mahamandal, Satara and Dyanjyoti Loksanchalit Sadhan Kendra, Gunaware, Dist. Satara



A group of women visitors watching a film in the AHD building varandah



Nearby school children visiting NARI-AHD

VIII. STAFF APPOINTMENTS TO PRESTIGIOUS POSITIONS

Dr. Chanda Nimbkar was nominated as a member of the following committees.

1. Biological Scientist member of the Institutional Animal Ethics Committee of Vidya Pratishthan's School of Biotechnology, Baramati on 30 June 2015.
2. Board of Trustees of the International Livestock Research Institute (ILRI), a CGIAR Institute based in Nairobi, Kenya on 4 November 2015. She is the only Indian member of the Board at present.
3. International Advisory Committee, Centre for Tropical Livestock Genetics and Health. A joint venture of Roslin Institute and SRUC, Edinburgh and ILRI.
4. Bull Breeding Value Committee under National Dairy Plan-1, Government of India, Ministry of Agriculture and Farmers' Welfare.