11. Research Recommendations made for the Farmers : (Approved in Joint AGRESCO)

(i) Varieties

Following varieties of different spices have been developed by this station and released for different production conditions in the state.

Sr. No.	Name of the crop	Name of the Variety	Year of Release	Yield q/ha	Chief Characteristics
1.	Sorghum	C-10-2	1945	300-350	Medium plant height, narrow leaves, small earhead.
		S-1049	1955	275-350	Rapid growth and nutrition's, palatable, tender and juicy green forage, low HCN content.
		GFS-3	1984	500-550	More number of leaves, fodder quality excellent.
		GFS-4	1989	360-400	Good potentiality for multicut, its stalk is sweet and juicy, loose earhead and grains are white with read tinch.
		GFSH-1	1992	469 Single cut 650-700 Multicut	Multicut hybrid, dark green leaves compact earhead and grains are white, moderately salt tolerant.
		GFS- 5	1998	400-450	Multicut variety, stem sweet and thin, leaves are light green colour.
2.	Lucerne	GAUL-1	1975	800-1000 (Annual)	Plants tall, erect type, crown above the ground, vigorous growing, leaves are broad and light green colour, flowers are purple in colour. It gives 10-12 cutting in a year.
		GAUL-2	1980	800-950 (Annual)	Resistance to downy mildew, flowers are purple in colour.
		AL-3	2006	1000-1100 (Annual)	The variety, Anand Lucerne-3 (AL-3) is recommended for Lucerne growing areas of Middle Gujarat. It yields nutritious and palatable fodder continuously for 2 to 3 years as well as it gives more herbage. It has good regeneration capacity and negligible incidence of pests and diseases. It has dark green foliage, oblong leaves, thick stem, 70.9 cm average plant height with 47 tillers/m. row..

Sr. No.	Name of the crop	Name of the Variety	Year of Release	Yield q/ha	Chief Characteristics
3.	Cowpea	GFC-1	1980	250-300	Trailing type plants, dark green pods, days to 50 % flowering is 65-70 days, recommended for *Kharif* sowing.
		GFC-2	1980	270-350	Performed well in summer season. Trailing type plants, dark green pods.
		GFC-3	1980	270-330	Performed well during *Kharif* season, trailing type plants.
		GFC-4	1980	290-350	Performed well during summer season.
4.	Marvel grass	GMG-1	1980	60-70 DFY rainfed 100-120 DFY irrigated	Seeds are very small, plants are sturdy, profuse tillering having 32-48 per cent leafiness. Suitable for making hay. Producer high quality of hay as well as green forage in short time.
		GAMG-2 (MG-12)	2009	185-190 GFY 80-85 DMY	Looking to the yield performance it gave 26.4 and 28.7 percent yield of green fodder and dry matter yield than GMG-1. More palatable as compared to GMG-1
5.	Dharaf grass	GAUD-1	1979	150-200	Suitability in medium black soils, sessile spike lets in groups, seeds pale yellowish in colour with oval shape.
6.	Hybrid Napier	APBN-1	2001	Ist year 2000 GFY IInd year 1500 GFY IIIrd year 1000 to 1200 GFY	The stems are less fibrous, tillers are more, faster growth habit, foliage dark green plant semi erect, tender leaves.
7.	Forage Pearl millet	GFB-1	2005	Single cut: 350-400 GFY Multicut: 600-800 GFY	Dark green foliage, high leaf stem ratio, maximum tillering capacity, good regeneration capacity, suitable in summer condition.

(ii) Research Recommendations for the Farmers : (also crop wise) (1984) on wards)

AGRONOMY & QUALITY EVALUATION :

FORAGE SORGHUM :

* The farmers of middle Gujarat Agro-climatic Zone growing *kharif* or summer sorghum in zinc deficient soils are advised to add FYM @ 10 t/ha every year and Zinc sulphate @ 25 kg/ha every third year for getting higher green and dry matter yield as well as good quality fodder (NICBR 1:2.10).

  The marginal farmers may apply only Zinc sulphate once in three years without FYM (ICBR 1: 2.73). In all the cases N and P should be applied @ 80 and 40 kg/ha, respectively.

* The farmers of Middle Gujarat Agro-climatic Zone growing fodder sorghum variety SSG 59-3 are advised to treat the seed with Azotobacter for getting higher dry matter yield and crude protein production. Nitrogen should also be applied @ 50 kg/ha in two equal splits, first as basal and the second 30 DAS for one cutting management and for two cuttings management top dressing should be done immediately after first cutting.

* Farmers of Middle Gujarat Agro-climatic Zone III growing sorghum variety SSG.59-3 in kharif season in soils having medium availability of phosphorus and deficient level of sulphur are advised to apply 40 kg phosphorus (87 kg DAP) and 20 kg sulphur (133 kg gypsum) per hectare every year to obtain maximum forage yield, total returns, net ICBR and better quality (crude protein and digestible dry matter production) of forage. These levels also remarkably reduced the HCN content in leaf (11 to 33 %) and shoot (12 to 156 %) of forage sorghum. (A common basal dose of 25 kg N/ha at the time of sowing, 25 kg N/ha at 30 DAS and 25 kg N/ha after the first cut i.e., 60 DAS should be applied).

* Farmers of Middle Gujarat Agro-climatic Zone III growing forage sorghum in *kharif* season in soils having marginal available zinc and Fe status are advised to apply 8 Kg $ZnSO_4$ + 15 Kg $FeSO_4$ per ha every year to obtain higher forage yield, total return, net ICBR and better forage quality (crude protein and digestible dry matter production). Alternatively, the farmers can also supplement the micronutrients by 1.0 % foliar application of micronutrient mixture having

concentration of Fe-6.0%, Mn-1.0%, Zn-4.0%, Cu-0.3% and B-0.5% equivalent to Government notified grade-III Zn-4.0 %, Cu-0.3 % and B-0.5 % equivalent to Government notified grade-III (Fe deficiency) at 20, 30 and 40 days after sowing (A common basal dose of 25 Kg N + 25 Kg P_2O_5/ha and 25 kg N/ha after one month of sowing should also be applied).

LUCERNE :

FORAGE PRODUCTION :

* Lucerne varieties SS-627 and Anand-2 should be sown early by line sowing during second week of November for obtaining higher forage yield and net realization.
* Lucerne variety Anand-2 and SS-627 should be sown by line sowing at the seed rate of 10 kg/ha for obtaining higher forage yield and net realization.
* Farmers of middle Gujarat Zone growing lucerne for green forage in medium fertile soils are advised to apply 50 kg P_2O_5/ha and 50 kg K_2O/ha in addition to 20 kg N/ha as basal dose for getting the maximum net realization from variety Anand-2.
* Farmers of AES-II of middle Gujarat Zone cultivating lucerne crop are advised to irrigate their crop through sprinkler instead of following surface method of irrigation to save about 15 % water and get about 24 % more income per hectare. They should irrigate the crop at 11-12 days till January, 8-10 days during February and weekly interval during March and April. They should operate the system for 2.5 hrs. to apply about 40 mm depth of irrigation. The system should be placed at 12 m x 12 m grid and operate at 2 1/2 kg/cm2 pressure).

SEED PRODUCTION :

* Farmers of middle Gujarat Agro-climatic Zone III growing Lucerne variety GAUL-1 are advised to apply 40 kg S/ha in the form of gypsum (300 kg/ha) and 25 kg $ZnSO_4$ in soils having Zn status marginal to deficient to obtain higher seed yield of lucerne and net returns. A common basal dose of 10 tones FYM/ha and 25:50:50 kg NPK/ha should also be applied to the crop.

* For obtaining higher realization and seed yield of lucerne, variety Anand-2 should be sown by line sowing during second week of November (15th) by keeping seed rate 5 kg/ha. No phosphorus is required under Anand soil conditions where availability of P_2O_5 is high.
* Under North Gujarat Zone soil conditions, where availability of P is medium, the farmers are advised to sow lucerne (Var. Anand-2) during last week of October at a spacing of 25 cm with a seed rate of 10 kg/ha and application of P @ 80 kg/ha.

MAIZE :

* Farmers of Middle Gujarat Agro-climatic Zone are advised to adopt *rabi* forage production system of cross sowing of Kent variety of oat with maize (Ganga safed-2) at 25 cm apart for obtaining higher green and dry matter production, crude protein and net return.
* Farmers of Middle Gujarat Agro-climatic Zone growing maize variety Gujarat Maize-1 in *rabi* season are advised to use seed rate of 80 kg/ha. They are also advised to apply 140 kg N/ha [50 % as basal and 50 % as top dressing (30 DAS) to get 19 % more income]. When status of the available P is medium, application of P was not beneficial.
* Farmers of Middle Gujarat Agro-climatic Zone III growing maize variety Gujarat Maize-2 in *kharif* season are advised to apply every year multi-micronutrients consisting of Fe-2.0 %, Mn-0.5 %, Zn-5.0 %, Cu- 0.2 % and B-0.5 % equivalent to Government notified grade-V for soil application @ 20 kg/ha having marginal status of Zn and Fe to obtain higher forage yield, total return, net ICBR and better forage quality (Crude protein and digestible dry matter production). Alternatively, the micronutrients can be supplemented by 1.0 % foliar application of multi-micronutrients mixture having Fe-2.0 %, Mn 0.5 %, Zn-8.0%, Cu-0.5% and B-0.5% equivalent to government notified grade-I (Zn deficiency) at 20, 30 and 40 days after sowing. (A common basal dose of 40 Kg N + 40 Kg P_2O_5/ha and 40 Kg N/ha after 30 days of sowing also be applied).

***RAJKA BAJRA*:**

* The farmers of Middle Gujarat Agro climatic Zone growing *Rajka bajra* for fodder purpose are advised to use seed rate of 12 kg/ ha keeping the sowing distance 45 cm between the rows and fertilize the crop with 100 kg N/ha (50 kg

N/ha as basal and 50 kg N/ha just after first cut). An additional 50 kg N/ha should be given after each cut. The application of P_2O_5/ha is not beneficial, when native P is medium to high.

* The farmers of middle Gujarat agro-climatic zone- III (AES-II) growing forage *bajra* are advised to grow genotype AFB-1 or AFB-2 (GFB-1) for four cuts at an interval of 40 + 25 + 25 + 25 days and harvest the crop at an cutting (stubble) height of 15.0 cm above the ground for higher forage production with better quality and for getting higher net realization.

OATS:

* The farmers of Middle Gujarat Argo-climatic Zone are advised to grow Oats (Kent or JHO- 822) with the application of 80 kg N/ ha for getting higher green and dry matter yield as well as crude protein. Nitrogen should be applied in three splits, i.e. 50 % as basal and 25 % each after 30 days of sowing and after first cut. There should be two cuttings first 50 days after sowing and the second at 50 % flowering stage (NICBR 1:7.69). For marginal and sub-marginal farmers' nitrogen recommendation is 40 kg/ ha applied in three splits (NICBR 1: 8.95).
* Farmers of Middle Gujarat Agro-climatic Zone are advised to adopt *rabi* forage production system of cross sowing of Kent variety of oat with maize (Ganga safed-2) at 25 cm apart for obtaining higher green and dry matter production, crude protein and net return.
* Farmer of Middle Gujarat Argo-climatic Zone growing Oat (JHO-822) for green forage are advised to fertilize the crop with 60 kg N/ha (50% as basal and 50 % as top dressing 30 DAS) for getting maximum green forage yield and 24 % increased income.
* Farmer of AEC-II of Middle Gujarat Zone growing Oats variety Kent for dual purpose are advised to apply 80 kg N/ ha (50% at sowing and 50 % after first cut 50-55 DAS) to obtain higher forage and seed yield as well as maximum net realization.

PANDADIU **(Wild Chicory) :**

* The farmers of middle Gujarat agro-climatic zone- III (AES-II) growing *pandadiu* are advised to use seed rate of 10 kg/ha and fertilize the crop with 45 kg N/ha after each cut to obtain higher green forage, dry matter and crude protein yields and for getting higher net realization. (A common basal dose of 30 kg N/ha + 30 kg P_2O_5/ha should also be applied to the crop).
* The farmers of middle Gujarat agro-climatic zone- III (AES-II) growing lucerne and *pandadiu* crops are advised to adopt mixed cropping of lucerne and *pandadiu* with seed ratio proportion of 7.5 + 2.5 kg/ha of lucerne + *pandadiu* alongwith 30 kg N/ha basal and 15 kg N/ha after each cutting to obtain higher green forage, dry matter and crude protein yields and for getting higher net realization. (A common basal application of 10 t FYM/ha + 50 kg P_2O_5/ha should also be done to the crop).

HYBRID NAPIER:

* Farmers of Middle Gujarat Agro-climatic Zone –III growing hybrid napier cv. APBN-1 are advised to follow 100 x 50 cm or 50 x 50 cm spacing and fertilize with 75 kg N/ ha after each cut up to two years. (A common basal dose of FYM 10 t / ha + 50 kg N + 50 kg P_2O_5 / ha should also be applied to the crop).
* Intercrop cowpea GFC-3 during *kharif* and lucerne GAUL-1 during *rabi* season should be sown in between two lines of hybrid napier (150 cm x 25 cm) at 25 cm apart to obtain maximum forage production of hybrid napier and the intercrops (Cowpea) *kharif* and (Lucerne) *rabi*. It also improved the forage quality. This practice in advantageous successively for two years and thereafter it is not economical due to excessive decline in yield under Middle Gujarat Agro-climatic conditions.
* Intercrop Guar during *kharif* and lucerne variety GAUL-2 during *rabi* season should be sown in between two lines of hybrid napier (150 cm x 50 cm) at 25 cm apart to obtain maximum forage yields of hybrid napier and the intercrops Guar (*Kharif*) and (Lucerne) *rabi* under North Gujarat Agro-climatic zone. Hybrid napier crop is advantageous to keep in the filed for two years only.

GUINEA GRASS :

* The farmers of Middle Gujarat Agro-climatic zone growing guinea grass are advised to give Azospirillum treatment (3 packet/ ha of ASN 108 living cell/ g) to guinea grass seedlings and apply 30 kg N/ha during each cutting for getting higher green forage, dry matter and crude protein yields of guinea grass grown for three years.

CROP SEQUENCE :

* The farmers of middle Gujarat agro-climatic zone- III (AES-II) are advised to adopt cropping system of Hybrid napier (APBN-1) with cowpea (EC-4216) as inter crop in *kharif* and lucerne (GAUL-1) in *rabi* for obtaining the higher net return (CBR-1:2.05). It gives higher forage production round the year for two to three years cycle under irrigated condition.
* The farmers of Middle Gujarat, Agro-climatic Zone-III (AES-II) are advised to grow sorghum (S-1049) (single cut) in *kharif*, sunflower (EC-68414) in semi *rabi* and lucerne (GAUL-1) in *rabi* season with application of 100% RDF to each crop along with 30 t FYM/ha to *kharif* crop to obtain higher forage production, quality as well as higher net realization (CBR- 1:1.65) under irrigated conditions.

CROP PROTECTION :

* One spray of endosulfan 0.075 % + mancozeb 0.2 % is recommended to avoid loss (16.49 %) (ICBR 1:12.93) in seed yield due to different insect pests (*Helicoverpa armigera* and *Spodoptera litura*) in lucerne crop under middle Gujarat Agro-climatic Zone.
* For the effective and economic control of sucking pests (Aphid, jassid and thrips) and anthracnose and yellow mosaic virus in lucerne the farmers of middle Gujarat are advised to apply endosulfan 0.07 % + mancozeb 0.02 % twice (each spray after 10 days of cut) during winter season when pest population is high (ICBR 1:18.69).
* For the effective and economic control of *Spodoptera, Helicoverpa* and rust disease in lucerne, following module is recommended:

i) Raising of marigold (0.5 m apart) on border of the field and on inside bunds.

ii) Raising the castor plants (3.0 m apart) on border of the field and on inside bunds.

iii) Application of NSE 5 % and mancozeb 0.2 % at the time of flowering.

iv) Application of HNPV and SNPV @ 250 LE/ha at the appearance of 2 larvae/m2 followed by application of mancozeb 0.2 % (ICBR 1:3.87).

* The farmers of middle Gujarat are advised to give seed treatment of carbendzim @ 2.0 g/kg seed (ICBR 1:128.66) for the management of root rot in forage cowpea.