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DISSEMINATION OF TECHNOLOGIES THROUGH FARMER'S PARTICIPATORY APPROACH IN KACHCHH, GUJARAT

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Farmer's Participatory Action Research Programme
Central Water Commission
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Central Arid Zone Research Institute
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Kukma-Bhuj - 370105, Gujarat, India







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FOREWORD

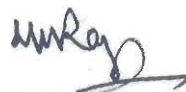
Regional Research Station of CAZRI for arid Gujarat was established on 26th March 1987 at Kukma, Bhuj in Kachchh district. The major objectives of the Station are to identify, develop and transfer situation-specific agro-technologies for sustainable development of agriculture and allied sectors in arid areas of Gujarat. The Station has so far identified several improved genotypes of grasses, suitable forage legumes, silvipastoral, and agri-horti models and improved cultivars of some field crops along with their intercropping systems.

To take the technologies to the farmer's field, a Farmer's Participatory Action Research Programme was initiated by CAZRI at some of its Stations, including Kukma-Bhuj, which was funded by the Central Water Commission, Ministry of Water Resources, Govt. of India, New Delhi. Under this project, technology demonstration on popularisation of important *kharif* and *rabi* crops, cropping systems under irrigated and rainfed situations, farming systems, pressurised irrigation, improved cultivation of ber and rodent control were carried out in farmer's field with active participation of the farmers. These activities led to improvement in farm income of the participating farmers.

I appreciate the efforts of the Station for successful conduct of the Farmer's Participatory Action Research Programme in Kachchh and of the authors in compiling highlights of the achievements through this publication. I wish that the publication becomes useful to the farmers, extension agencies and other allied institutions associated in improving productivity and sustainability of agriculture in the region.

Date : 6 July, 2010

Place : Jodhpur



M. M. Roy

Director
CAZRI, Jodhpur



PREFACE

Agricultural research in India has largely and significantly contributed to increase the production and productivity of many crops. But still majority of technologies have not made their presence in the real farming situation. The weakness in the extension system, availability of region specific technologies, farmer's reluctance to the technology and resource availability with the farmers for implementation of the technology are some of the constraints in technology adoption. Agriculture in Kachchh region of Gujarat has witnessed remarkable changes in the recent past. High input intensive irrigated agriculture/ horticulture and low input rainfed agriculture are practised in the region. In Kachchh the rainfall is scanty, erratic and irregular with annual average of 376 mm, distributed in 11 rainy days (average of 1990-2009). Apart from the climatic constraints, the area faces other problems as well. Soil related constraints include low organic matter status, inherently low soil fertility in terms of macro and micro nutrients, crusting, presence of hard pan and shallow soil depths. The region experiences declining water table and poor water quality. The cultivated land constitutes only 15% of the total district area. The major crops in the district are pearl millet, sorghum, pulses like green gram, moth bean and cash crops like clusterbean, groundnut and cotton. Monoculture of commercial crops is prevailing in the region, which aggravates the depletion of resource base in this fragile eco-system. There are many technologies available to address the soil related problems and to address the low yield and risk in rainfed agriculture. There is good amount of scope in developing horticultural enterprise in the region. For proper adoption, the technology needs to reach the farmers.

Realising the constraints in technology dissemination and to bridge the gap between research and extension, a Farmers Participatory Action Research Programme was initiated at Central Arid Zone Research Institute, Regional Research Station, Kukma-Bhuj, with financial assistance from Central Water Commission, Ministry of Water Resources, Govt. of India, New Delhi for outreaching the developed technologies in farmers field. After conducting preliminary surveys, five villages namely Dhaneti, Gander, Kotda, Khambhra and

Tharawda in Kachchh district were selected for implementation of project. The technologies demonstrated included popularisation of crop varieties, cropping system (rainfed and irrigated) with INM practices, farming system, pressurised irrigation, improved cultivation of ber and rodent control.

The project was implemented from rabi 2008 to rabi 2009. The results obtained in the demonstrations were highly encouraging and a large number of farmers visited and appreciated the demonstrated technologies.

The guidance, input and encouragement received from the former Directors of CAZRI, Dr. K. P. R. Vittal and Dr. N. V. Patil and the cooperation of all the staff members of Regional Research Station of CAZRI at Bhuj and the participated farmers, have contributed greatly to the success of the programme and is hereby thankfully acknowledged.

This publication entitled "Dissemination of technologies through farmer's participatory approach in Kachchh, Gujarat" is funded by Farmer's Participatory Action Research Programme of Central Water Commission, Ministry of Water Resources, Govt. of India, New Delhi and authors sincerely thank the authorities for the financial assistance.

Date: 6 July, 2010
Place: Kukma, Bhuj

Devi Dayal
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1. Introduction

Kachchh is the largest district (45,652 sq km) in the state of Gujarat and the second largest district after Leh in India. The significant portion of the population depends upon agriculture and animal based farming system for their livelihood. The district witnesses both intensive high input oriented irrigated agriculture and low input, subsistence rainfed agriculture. The region is located in the North West agro-climatic zone in Gujarat and experiences arid climate frequented with droughts and erratic rainfall. The indiscriminate use of natural resources, due to lack of awareness has started signaling its adverse impact on environment by way of deepening of water table, degradation of the quality of underground water, increase of salinity, depletion of macro and micronutrients and soil organic carbon etc. Many eco-friendly and sustainable technologies have been developed by the State Agricultural Universities, ICAR institutions and other allied institutions that have contributed to increased production and profitability on a sustainable basis. But adoption of the technologies by the farmers in the real farming situation is not coping up with the need of the hour mainly due to various reasons like lack of sufficient and appropriate extension activities, compatibility of technologies to the small and resource poor farmers etc.

A project was undertaken in Kachchh district of Gujarat to demonstrate the proven technologies in farmer's field under Farmer's Participatory Action Research Programme funded by Central Water Commission, Ministry of Water Resources, Govt. of India, New Delhi, by Central Arid Zone Research Institute, Regional Research Station, Kukma-Bhuj, Gujarat. The project was started during the *rabi* season of 2008. The project was implemented in five villages in Dhaneti, Gander, Kotda, Tharawda and Khambhra in Kachchh district. The results of the demonstrations conducted on popularisation of varieties and cropping system, farming system, pressurised irrigation, improved cultivation of ber and rodent control during 2008-2009 and 2009-10 are presented in this bulletin.

1.1. Climate

The Kachchh region falls under arid ecosystem. The average annual rainfall is 376 mm (based on 1990-2009 data), spread in 11 rainy days with a coefficient of variation of 71.8%, which is highly variable and erratic leading to protracted droughts. Within a span of 23 years, six severe, three moderate and five mild meteorological droughts (IMD classification) were recorded. Apart from low and erratic rainfall, the region is characterized by high temperature (maximum 39-45 °C during May-June), high wind

velocity (19-37 km ph during July) and high potential evapo-transpiration (1750-1900 mm/year). In the absence of favourable conditions for agriculture, livestock rearing is the alternative source of livelihood for the majority of the rural population in the region.

The total rainfall received during 2008 was 337.7 mm in 19 rainy days whereas in 2009, a total of 521.2 mm rainfall was received in 12 rainy days (Figure 1 and 2).

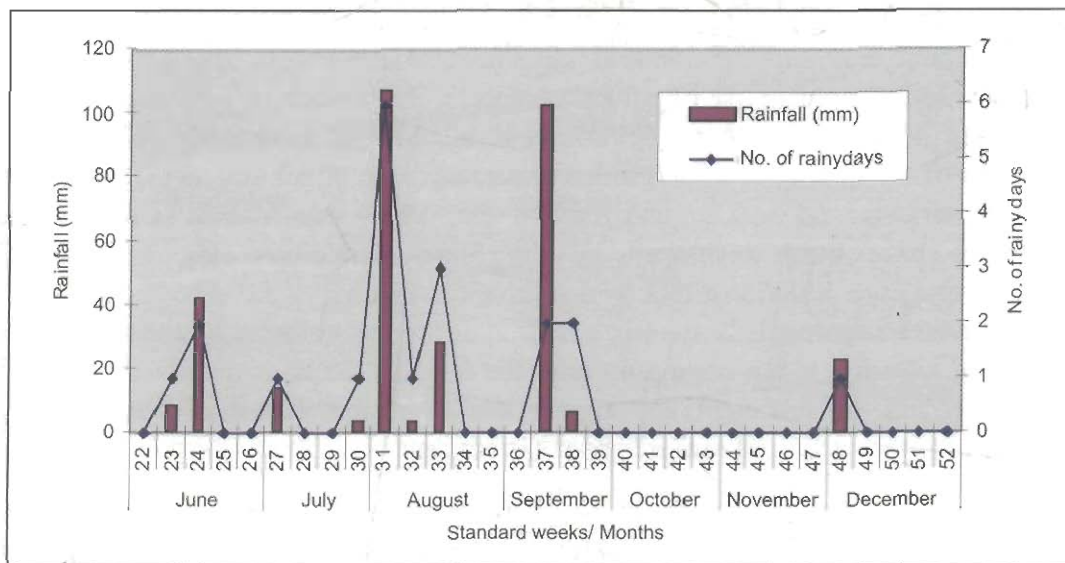


Fig 1. Rainfall pattern in Kachchh, Gujarat in the year 2008

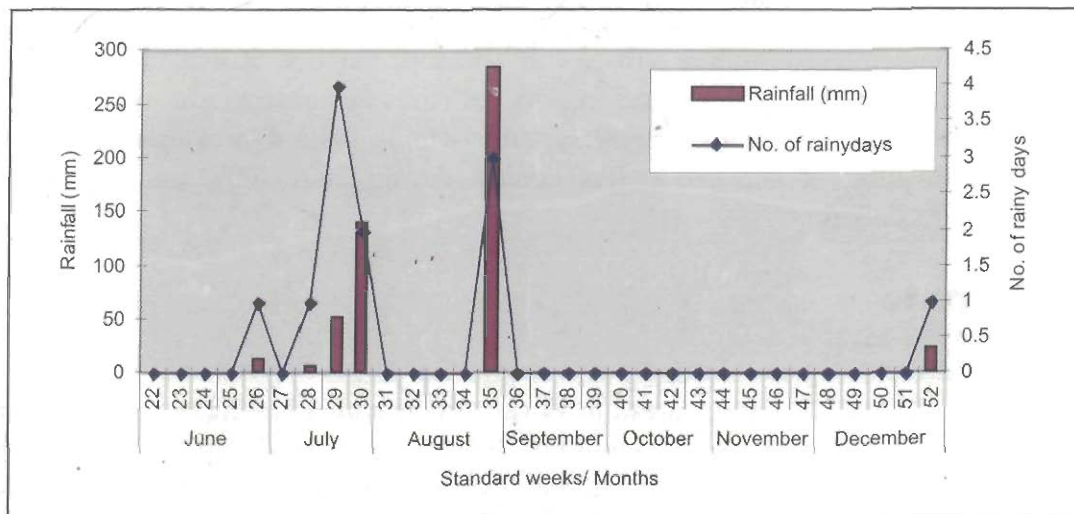


Fig 2. Rainfall pattern during the year 2009 in Kachchh, Gujarat

1.2. Land use

Cultivated land constitutes only 15% wherein only 5% is irrigated. Forest covers 7%, culturable waste 9%, Ranns and saline marshes 57%, Banni area 2% and unculturable waste land 11% (Figure 3). By virtue of its geographical location, it has a number of ecosystems. These include the dry thorn scrub forests with a dominance of *Acacia nilotica*, *A. arabica* and *Capparis deciduas*, *C. aphylla*; a unique saline desert ecosystem with a dominance of *Salvadora oleides* and *Prosopis juliflora*, and grassland ecosystems having prominence of *Cenchrus sp*, *Dicanthium sp etc*. Five per cent of the district area is under cultivable waste land indicating a vast potential for development of agriculture in the region. Also the availability of water from the proposed Narmada Water Canal would dramatically change the scenario of agriculture in Kachchh.

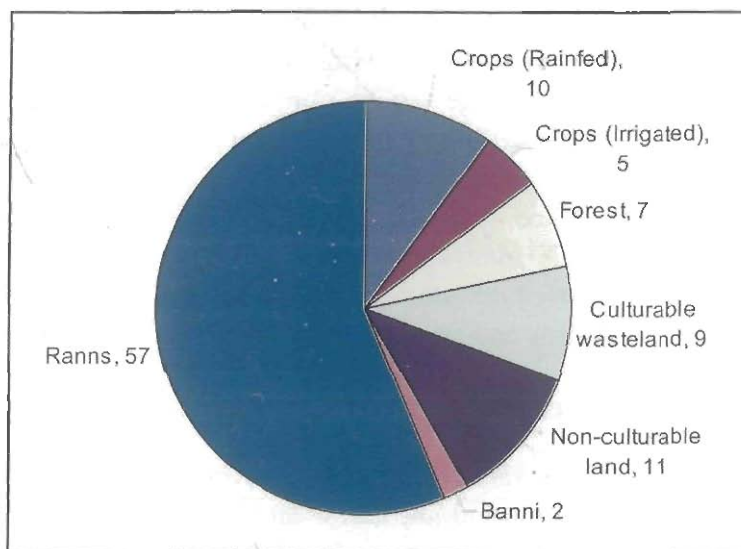


Fig 3. Land use pattern in Kachchh district, Gujarat

1.3. Soil and land resources

Geologically the rock formation of the area ranges in ages from middle Jurassic to late Tertiary. The rock associated with the area at present are mainly sand stone, lime stone, mud stone, schales, basalt and huge deposits of fluviomarine sand and mud. The CAZRI workers had grouped the soils of Kachchh into five textural groups (fine textured – 4.07%, moderately fine textured- 3.98%, medium textured- 3.02%, coarse textured- 11.13% and other miscellaneous- 63.1%) and 32 soil series and 52 soil mapping units. The soil pH ranges from 8.0 to 9.0 and electrical conductivity from 0.22 to 29.15 dScm⁻¹.

The soils are poor in organic carbon (0.28 to 0.62%) and phosphorus (4-18 kg ha⁻¹). The available potassium is medium to high in these soils. The soils of Kachchh are deficient in micronutrients like Zn and Mn. Coarse textured soils have the problem of excessive permeability leading to heavy loss of water and nutrients. The compact subsurface especially with shallow soils does not allow proper development of root systems in several crops and leads to decline in the yield.

1.4. Water resources

There are very limited groundwater resources in Kachchh. The minimum depth to ground water is 10-20 m. The discharge from open well is poor. The farmers mostly rely on tube well for irrigation. The excessive ground water exploitation has led to increased salinity mainly due to intrusion of sea water and deepening of ground water.

Because of inadequate irrigation facilities from major and medium projects, minor irrigation continues to play a vital role in irrigation. Due to absence of mountainous region, the existence of Rann and the scanty rainfall, the region does not have many rivers. The few rivers rising from either the northern or the central ranges are Khari, Kayala, Poor and Paat. None of these rivers are perennial or navigable. In arid region of Gujarat, the availability of surface water depends on the intensity, duration and amount of rainfall. Out of the total 1482.71 mcm runoff estimated in the region, 847.38 mcm water is being stored in different irrigation storage reservoirs and village tanks. Thus, nearly 57.15 percent of runoff is surplus and goes as waste into the sea and the Ranns.

1.5. Major crops and cropping systems

The major crops under rainfed farming systems in Kachchh are pearl millet, sorghum, clusterbean, sesame, groundnut, castor and cotton. Under irrigated condition, the major crops are groundnut, wheat, mustard, cotton and cumin. The average productivity over the last 10 years is 857 kg ha⁻¹ for pearl millet, 2669 kg ha⁻¹ for wheat, 397 kg ha⁻¹ for pulses, 248 kg ha⁻¹ for clusterbean, 1420 kg ha⁻¹ for castor, 1412 kg ha⁻¹ for groundnut, and 1194 kg ha⁻¹ for mustard.

Horticultural crops are grown in about 18500 ha in Kachchh district. The major horticultural crops are datepalm, mango, sapota, ber, banana, papaya, pomegranate and guava. The vegetable crops grown in the area are brinjal, potato, tomato, coriander, onion, chillies, ladies finger, cabbage, cauliflower, bottle gourd and bitter gourd. There are also medicinal plant growers who grow gugal, satavari, aloe vera, ashwagandha etc.

2. Methodology

A preliminary survey of 25 villages was carried out and five villages namely, Dhaneti, Gander, Kotda, Tharawda and Khambhra were selected based on the criteria laid down under the project. The scientists of Central Arid Zone Research Institute, Regional Research Station, Kukma-Bhuj, Gujarat carried out an in-depth analysis of the farming situation through Participatory Rural Appraisal (PRA) techniques in these villages. Each technology was demonstrated in 10 farmer's fields. Each farmer was guided to layout 5000 m² areas under improved practice and the rest of the field was cultivated according to his conventional practice. The aim was to provide demonstration in farmer's field for practising and assessing the effect of improved practice with that of traditional practice to both, the demonstrating farmers and the neighbors. The data on grain and straw yields were collected using net plot area and cost of cultivation and net returns were worked out by discussion with farmers and prevailing market rate of inputs and produce.

3. Major constraints for agricultural production and the selection of technologies for demonstration

The PRA and interaction with the farmers indicated the major constraints for agricultural production as follows.

In rainfed farming the crop failure due to aberrant weather was the main problem. The other constraint includes use of local varieties and low yields. The farmers practice suboptimal spacing, either too wide or too closer both leading to yield reductions.

The soil related problems include low fertility status of soils in terms of organic carbon, nitrogen, phosphorus, and potassium at some places and micronutrients like zinc and manganese, crust formation in the soil hindering germination and establishment of optimum plant stand and shallow soil depth with hard pan. The blanket application of fertilisers and top dressing of DAP are other inappropriate practices observed in the farmer's field. Farmers predominantly follow flood method of irrigation and in fields where drip and sprinkler method are practised; the water application was based on assumed interval method. Both these practices reduce the water use efficiency. Another problem observed was severe damages caused by rodents to the crops both in field as

well as in storage. Farmers lack adequate knowledge in safe application of rodenticide and most of the time non-target house hold animals and birds are being damaged.

The technology related constraints include non awareness of modern technologies and consequent low adoption and inadequate availability of quality seed and input materials.

Based on constraint analysis the technologies selected for demonstration were popularisation of improved varieties, improved cropping system involving integrated nutrient management and improved variety, demonstration of farming systems, efficient use of drip irrigation, popularisation of ber and arid horticulture and rodent control.

4. Technology interventions

4.1. Popularisation of crop varieties

Demonstration on popularisation of improved varieties was initiated during *rabi* season of 2008. Under this programme the demonstration of improved crop varieties of cumin and wheat were carried out during *rabi* 2008 and improved varieties of wheat and mustard were undertaken during *rabi* 2009. During *kharif* 2009, demonstrations on improved varieties of clusterbean and sesame were undertaken at the selected villages in Kachchh. Under these trials the local variety popular among farmers were used as check and the package of practices were as per farmer's practice under both the demonstrations.

4.1.1. Cumin

The farmers of selected villages are predominantly using the local varieties of cumin where the yield levels are low. Therefore during *rabi* 2008, varietal demonstrations of cumin variety GC-4 was undertaken at Dhaneti (Figure 4). There was 14.0% yield increase with the introduction of improved variety over local variety. Farmers recorded an additional income of Rs. 5400 ha⁻¹ with the use of improved variety over local and a BC ratio of 2.53 was recorded in technology demonstration against 2.28 in local variety (Figure 5).

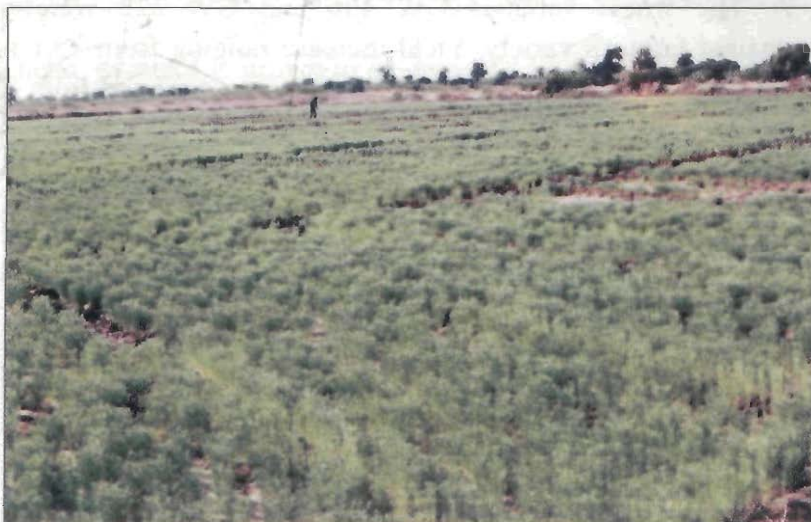


Fig 4. Demonstration of improved variety of cumin (GC 4) at Gander

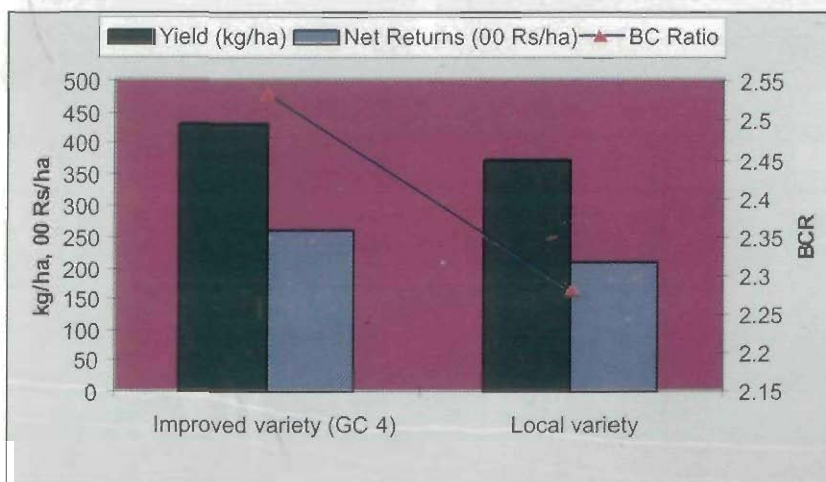


Fig 5. Yield and economics of technology demonstration on popularisation of cumin

4.1.2. Wheat

Wheat is one of the most preferred *rabi* crops in Kachchh. Local varieties in wheat are in vogue in the area, which are inherently low yielders. Therefore to popularise the improved varieties of wheat, three technology demonstrations were undertaken in village Kotda, in *rabi* 2008, one demonstration each in villages Gander and Kotda in *rabi*

2009 (Figure 6). The wheat varieties GW 496 and GW 322 were used for the demonstrations against farmer's variety. Yield increase ranging from 35.1 to 46.8% was noticed in variety GW 496; and in GW 322 the yield increase ranged from 22.1 to 32.2% over the local variety. Farmers on an average, obtained a net income advantage of 25070 Rs ha⁻¹ with variety GW 496 and 11545 Rs ha⁻¹ with variety GW 322, when compared with the local cultivars (Figure 7). The demonstrations were very well appreciated by farmers of the region.



Fig 6. Technology demonstration on improved variety of wheat in Kotda and Gander

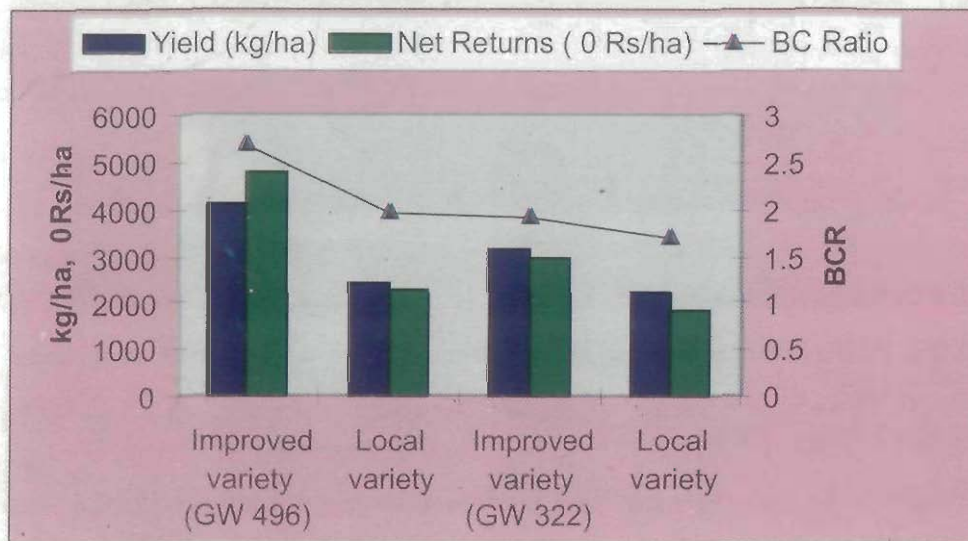


Fig 7. Yield and economics of demonstration on improved varieties of wheat

4.1.3. Mustard

In Kachchh, mustard is grown in an area of 14900 ha with a production of 22300 t. Demonstration on popularisation of improved varieties of mustard was carried out with active participation of farmers from villages Dhaneti, Kotda, Tharawda and Khambhra. All the three demonstrations were helpful to convince farmers about the superiority of improved variety GM 2 over their own traditional varieties (Figure 8). The yield increase was to the tune of 32.1 to 41.6% over local varieties (Figure 9). The results were encouraging to the farmers. They obtained a net monetary return of Rs. 27230 per ha with a BC ratio of 2.42 under the technology demonstration against local variety (Rs. 13580 per ha net returns and 1.87 BC ratio).



Fig 8. Technology demonstration on improved variety of mustard in Khambhra

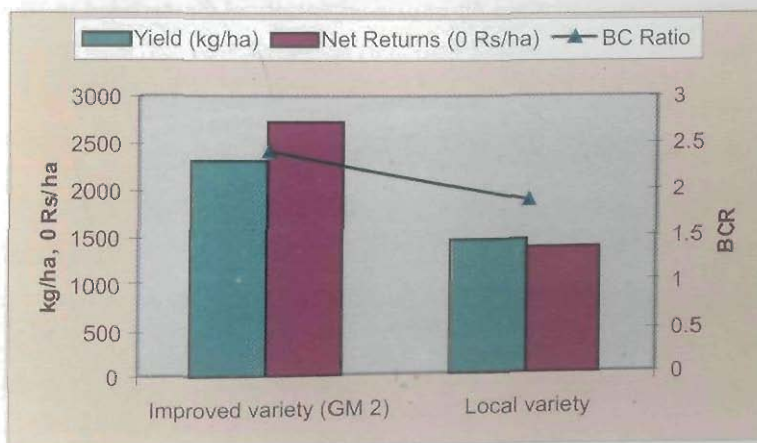


Fig 9. Yield and economics of technology demonstration on improved variety of mustard

4.1.4. Clusterbean

Clusterbean is an important rainfed cash crop of Kachchh region of Gujarat. Due to its remarkable ability to withstand drought and its importance in livestock nutrition, this crop find a major part of cropped area in the completely rainfed zones where sources of irrigation water is very limited. Local cultivars dominate the clusterbean cropped area in the region and therefore technology demonstrations on popularisation of improved varieties of clusterbean were attempted during *kharif* 2009 in two villages, namely Gander and Khambhra (Figure 10). Two demonstrations were carried out with the variety *maru guar* with farmer's cultivar as check. The yield increase under technology demonstration ranged from 27.8 to 45.3% over the local cultivars. Farmers on an average obtained an additional income of 3160 Rs ha⁻¹ by merely changing the variety. On an average a BC ratio of 1.98 recorded with improved cultivars with local cultivars recording only 1.68 (Figure 11). The farmers were convinced of the superiority of the technology and demand for seeds of improved variety of clusterbean increased significantly.



Fig 10. Technology demonstration on improved variety of clusterbean in Dhaneti

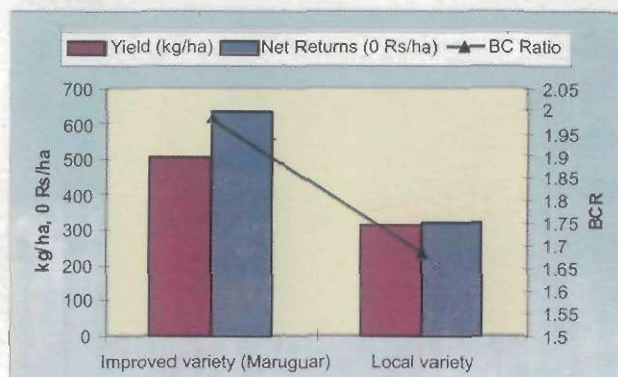


Fig 11. Yield and economics of technology demonstration on improved variety of clusterbean

4.1.5. Sesame

In Kachchh, sesame is grown in an area of 42300 ha, with a production of 213,00 t during the year 2007-08. The major constraints in obtaining good yield are use of local varieties, deficient or excess rainfall at flowering and pod formation and inadequate nutrition.

Three demonstrations on popularisation of improved variety of sesame were undertaken at villages Dhaneti and Khambhra in Kachchh (Figure 12). The demonstration on improved variety of sesame (GT 2) was helpful to increase BC ratio in the range of 2.16 to 2.31 compared to 1.69 to 1.88 with local variety. On an average, the yield increase was 23.4% in the demonstration over the local varieties. The net returns obtained with GT 2 ranged from Rs. 9,550 to 11,200 per ha as against 5,600 to 7,600 per ha under local variety (Figure 13).



Fig 12. Technology demonstration on improved variety of sesame in Khambhra

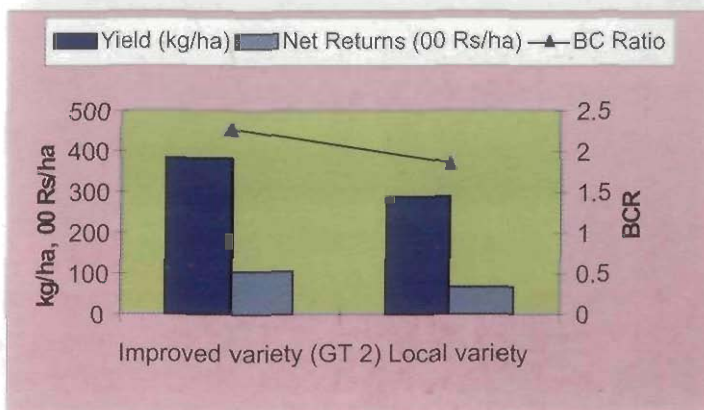


Fig 13. Yield and economics of technology demonstration on improved variety of sesame

4.2. Cropping system with Integrated Nutrient Management (INM)

The importance of nutrient management practices in crop production has not been given adequate attention by growers. By blanket application of fertiliser, without considering the nutrient availability in soil and the varied requirements by different crops, adequate crop yields cannot be realised. The excess application of fertiliser deteriorates both soil and water resources, apart from its effect on increasing cost of cultivation to the farmer. Realising the problems in nutrient management in farmer's field, technology demonstrations were carried out on integrated nutrient management practices in different crops. The demonstrations were conducted during *rabi*, 2008 with crops cumin and wheat and during *kharif* 2009 with clusterbean and sesame and during *rabi* 2009 with crops wheat and mustard. Soil test based integrated nutrient management practices were followed for each crop as per recommended package of practices for the region. Farmer's practice (blanket application of one or two bags of DAP per ha at sowing and topdressing of DAP at active vegetative stage) were used as control. Appropriate extra allowance in nitrogen and phosphorus were advocated wherever soil is rated as low in these nutrients.

4.2.1. Improved variety along with INM in cumin

Cumin is an important seed spice crop in the region. During the preliminary survey it was observed that proper nutrient management practices is not being followed in this crop. Therefore technology demonstration on INM was implemented in the village Dhaneti during *rabi* 2008 (Figure 14). The INM practices involved application of recommended dose of NPK (30:15: 0 NPK kg ha⁻¹ suitably adjusted with soil test values). The farmer's practices of application of only DAP and its top dressing was used as check. The INM practices gave 13.3% yield increase over farmer's practice and gave a BC ratio of 2.6 as compared to 2.32 with farmer's practice. The gross return and net returns was increased by 13.3 and 14.1% respectively by the adoption of the INM practices (Figure 15).



Fig 14. Technology demonstration on improved variety and INM in cumin at Dhaneti

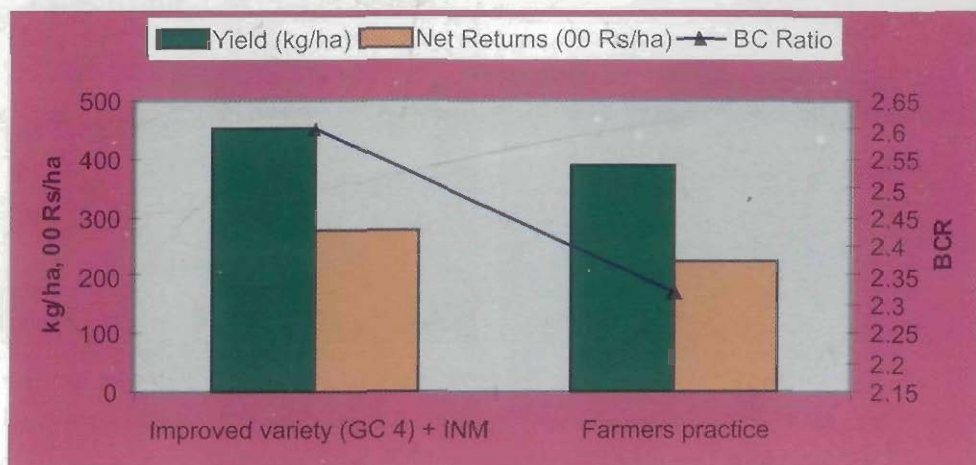


Fig 15. Yield and economics of technology demonstration on improved variety and INM in cumin

4.2.2. Improved variety along with INM in wheat

In order to address the nutrient management problem in farmer's field, where they predominantly rely on application of only DAP on a blanket basis for the wheat crop, technology demonstrations were conducted on INM practices in wheat with variety GW 496 and GW 322. During *rabi* 2008, three demonstrations were conducted at Kotda, two with variety GW 322 and one with variety GW 496. In *rabi* 2009, two demonstrations on INM in wheat variety GW 496 were carried out in villages Kotda and Gander (Figure 16). The INM practices adopted by the farmers include application of nutrients based on soil test report at the recommended rate ($120: 60$ N and P kg ha^{-1}). 100% P and 50% N were applied as basal, 25% N at 25 days after sowing and remaining 25% at 60 days after sowing. The fertiliser used were DAP and urea. This was followed in the 5000 m^2 plot under supervision by the scientists. In rest of the fields farmer's own practice (application of one bag DAP per ha at sowing and later one time top dressing with one bag DAP per ha) were followed. Farmers observed a significant improvement in yield and income benefits under the demonstration plot. The farmers of nearby areas who visited the trials also appreciated the visible effect of the technology in the field. There was a yield increase of 38.3% in GW 496 and 34.1% in GW 322, over farmer's practice. The extra income gained over the farmers practice was Rs. 24895 per ha in GW 496 and Rs. 16,245 per ha in GW 322 (Figure 17).



Fig 16. Technology demonstration on improved variety and INM in wheat at Kotda

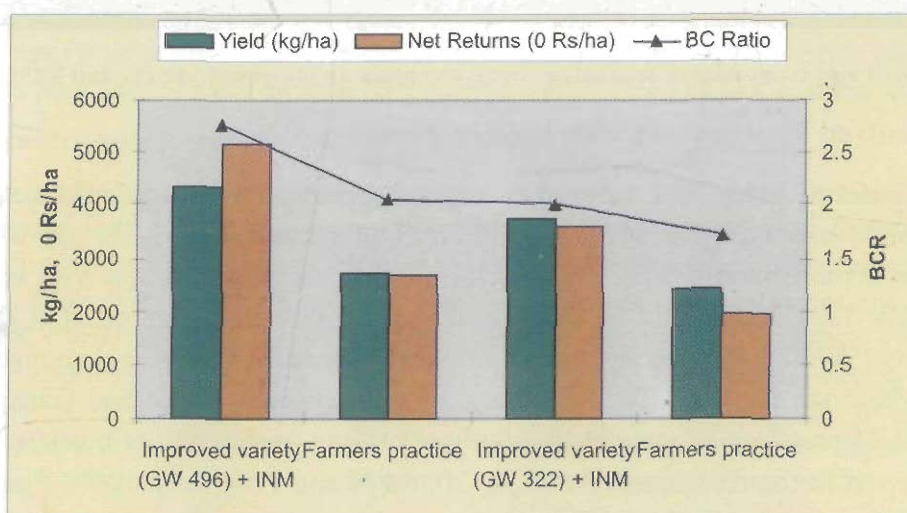


Fig 17. Yield and economics of technology demonstration on improved varieties and INM in wheat

4.2.3. Improved variety along with INM in mustard

Integrated Nutrient Management practices were demonstrated in mustard variety GM 2 in three farmer's field in *rabi* 2009, one each in Dhaneti, Khambhra and Kotda (Figure 18). The INM strategy includes application of recommended doses of fertilisers based on soil test values at right time and right quantity. The recommended rate was 50:50 NP kg ha⁻¹. Full P and 50% N (as DAP and urea) were applied basal and remaining 50% N were applied 30 days after sowing with urea. The farmer's practice of single application of DAP at sowing served as control. The yield increase by the adoption of INM practices was 34.3% over farmer's practice. Farmers obtained an additional income of Rs 14530 per ha by adoption of INM practices over their own practice (Figure 19).



Fig 18. Technology demonstration on improved variety and INM in mustard at Dhaneti

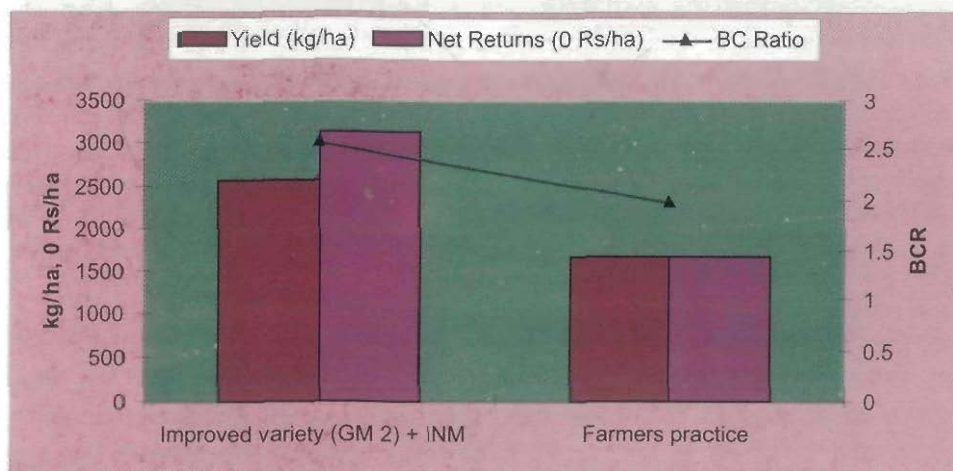


Fig 19. Yield and economics of technology demonstration on improved variety and INM in mustard

4.2.4. Improved variety along with INM in clusterbean

The blanket application of fertilisers is generally followed in the area. By this practice adequate nutrition cannot be assured to the crop to harness the maximum yield. This practice cause not only reduction in yield, but also an imbalance of nutrients in soil and thus farming become unsustainable in a short period of time. Four demonstrations on integrated nutrient management in clusterbean variety “*maru guar*” was undertaken in villages Gander, Dhaneti and Kotda in Kachchh district during *kharif* 2009. The INM practices includes application of recommended dose of NPK (20:40:0 kg ha⁻¹) through

DAP and urea, instead of farmer's practice (application of only DAP and its top dressing). On an average, 44.8% yield increase was noticed by farmers and a net return of Rs. 5300 per ha was obtained over and above the farmer's practices (Figure 20).

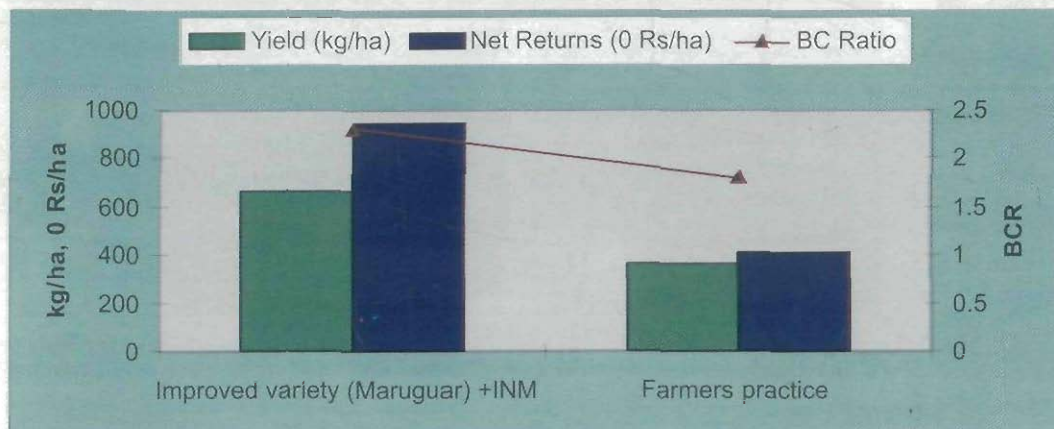


Fig 20. Yield and economics of technology demonstration on improved variety and INM in clusterbean

4.2.5. Improved variety along with INM in sesame

Two technology demonstrations on cropping system with sesame variety GT 2 following integrated nutrient management practices were implemented in the village Kotda during 2009 *kharif*. Under the INM, nutrients were applied as per the recommendation (NPK @ 25, 25, 0 kg ha⁻¹) taking into account the soil test values. The INM practices gave 21.5% more yield, 30.4% higher net returns and BC ratio of 2.29 compared with a BC ratio of 2.0 in the farmer's practice (Figure 21).

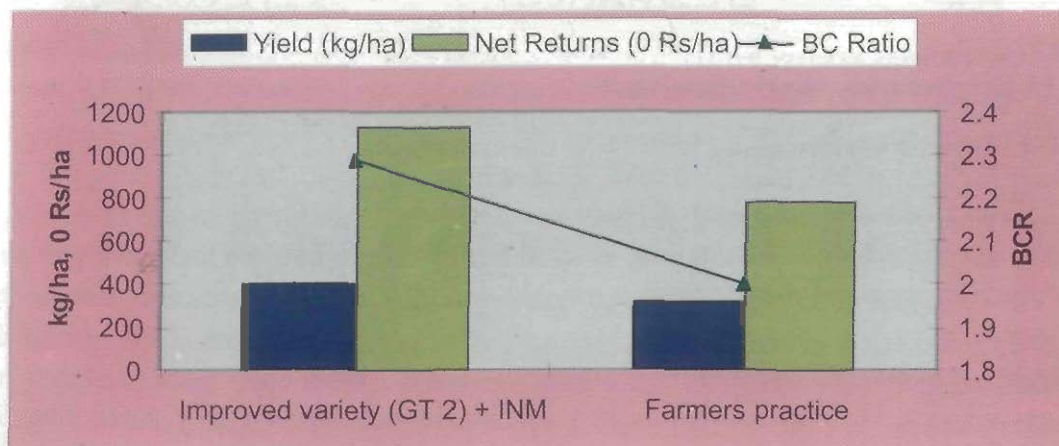


Fig 21. Yield and economics of technology demonstration on improved variety and INM in sesame

4.3. Intercropping

Monocropping is commonly practiced in Kachchh district. Under rainfed farming situation the failures of the crops are common due to erratic nature of rainfall. It is established by research that intercropping system utilizes all the inputs more efficiently and is more sustainable and profitable than the sole cropping under rainfed condition. Also it provides farmers with some income in case of failure of any one crop. Four different intercropping systems namely clusterbean + sesame, castor + sesame, castor + clusterbean and castor + greengram were demonstrated in farmer's field. These intercropping systems were compared with farmer's practice of monocropping. The results of demonstrations on intercropping in Gander are presented in this section.

4.3.1. Clusterbean + sesame intercropping

The clusterbean and sesame are important commercial crops of arid region of Gujarat. Clusterbean is cultivated in an average area of 81,700 ha with a mean production of 46400 t during 2007-08 whereas, sesame was grown in an area of 42,300 ha, with a production of 21300 t. The yields of these crops are highly constrained by the climatic variability. The yields of clusterbean vary widely with coefficient of variation of 90.0%, indicating that the yields of these crops are not sustainable. As intercropping is more sustainable and profitable than the sole cropping, a technological demonstration on intercropping of clusterbean + sesame in 2:1 ratio was implemented in village Gander (Figure 22).

In the intercropping system, clusterbean produced yield of 490 kg ha⁻¹ and sesame 140 kg ha⁻¹. The intercropping of clusterbean + sesame in 2:1 ratio provided a net return of Rs. 11574 per ha with BC ratio of 2.41. The net return obtained by the intercropping was higher by 41.6% over sole cropping of clusterbean and by 20.9% over sole cropping of sesame. The intercropping system recorded a BC ratio of 2.41 as against 1.94 with sole clusterbean and 2.06 with sole sesame (Figure 23).



Fig 22. Clusterbean + sesame intercropping

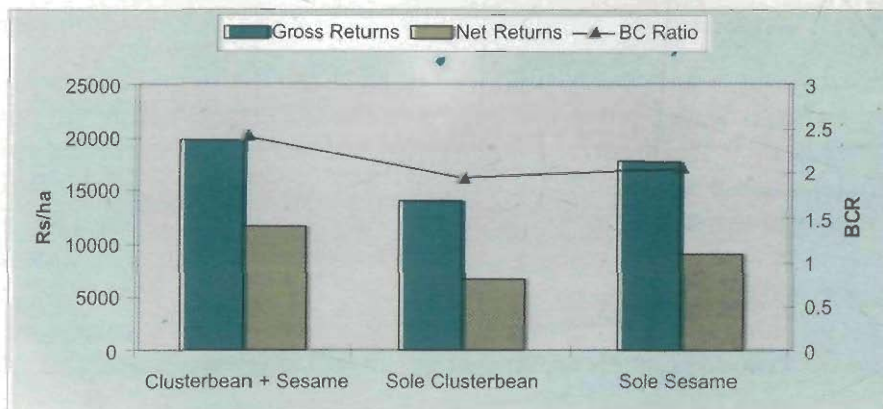


Fig 23. Yield and economics of intercropping system with clusterbean + sesame

4.3.2. Castor + sesame intercropping

Castor and sesame are important oilseed crops of arid region of Gujarat. In 2007-08, castor was cultivated in 54900 ha area with a production of 101400 t. Sesame is another very important oil seed crop in Kachchh. The yields of these crops are highly constrained by the climatic variability. Farmers in the Kachchh grow castor as monocrop with wider inter row space. During the initial stages when the growth of castor is slow, the interspaces can be utilised for growing various inter crops to gain additional income and to safe guard against crop failure due to biotic and abiotic constraints.

A demonstration on intercropping of castor with sesame was carried out in Gander during *kharif* 2009 in a row ratio of 2: 3 (Figure 24). The sole cropping, which was a usual practice was also undertaken as control. Castor in the intercropping system produced 900 kg ha⁻¹ and sesame 320 kg ha⁻¹. Farmers obtained a net return of Rs. 22500 per ha with a BC ratio of 2.41 under the intercropping system. They observed an income advantage of Rs.9000 per ha over sole cropping of castor and Rs. 13350 per ha over sole cropping of sesame by adoption of intercropping system (Figure 25). The demonstration was well appreciated by growers of the village and nearby areas.



Fig 24. Castor + sesame intercropping at harvest of sesame at Gander, Kachchh

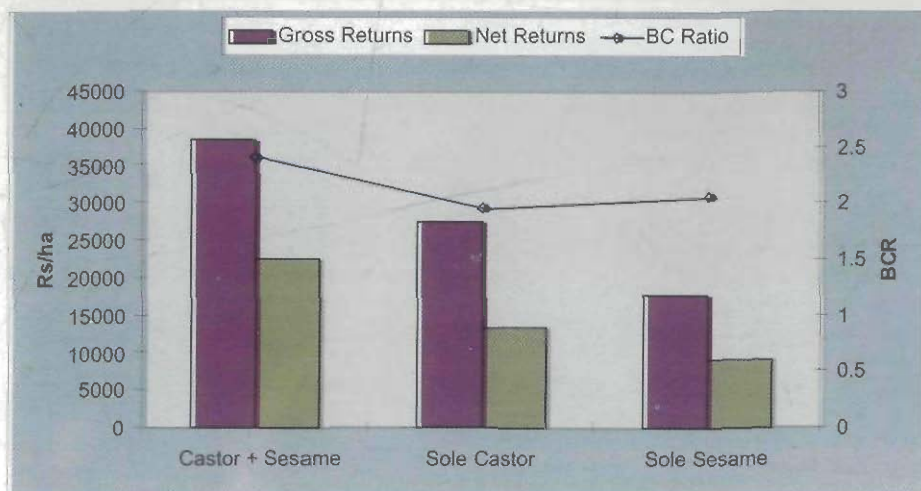


Fig 25. Yield and economics of castor + sesame intercropping

4.3.3. Castor + clusterbean intercropping

Castor being an important cash crop, it is mainly grown as mono crop by the farmers allowing a wider spacing of 180 cm. It is a common practice by farmers who are also rearing live stock, to go for clusterbean separately to meet the fodder requirement apart from economic benefit out of the grain yield. Under the FPARP project it was advocated to farmers to combine both castor and clusterbean in 1: 3 ratio to fetch higher income as well as to meet fodder requirements. The demonstration was conducted at Gander in *kharif* 2009 (Figure 26). Under intercropping system castor produced an yield of 950 kg ha⁻¹ and clusterbean 475 kg ha⁻¹. The intercropping system gave a net monetary return of Rs. 21150 per ha with a BC ratio of 2.46 (Figure 27). The farmers realised an income advantage of Rs.7650 per ha over sole cropping of castor and Rs. 14390 per ha over sole cropping of clusterbean by adoption of the intercropping system, which also made it possible to meet their fodder requirements. The farmers were also convinced of the indirect benefit of soil enrichment by inclusion of the leguminous crop in the system.



Fig 26. Castor + clusterbean intercropping at Gander

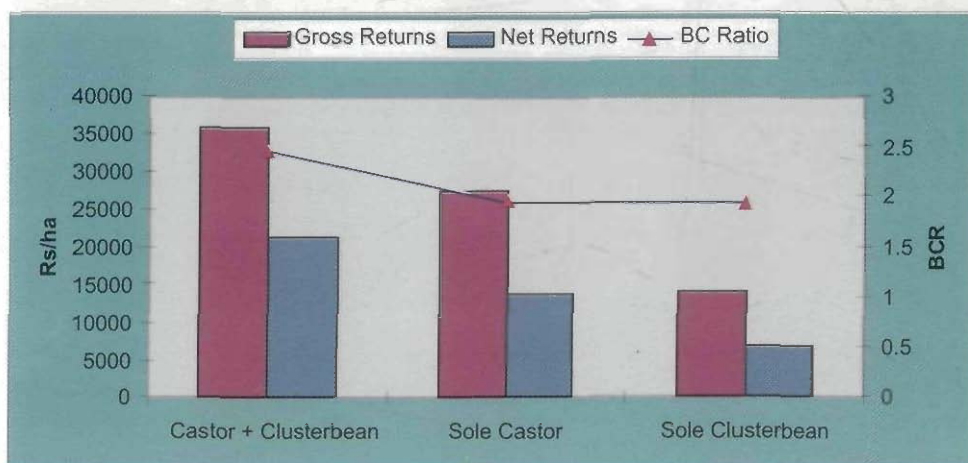


Fig 27. Yield and economics of castor + clusterbean intercropping at Gander

4.3.4. Castor + green gram intercropping

Greengram, a short duration crop is better suited as an intercrop with long duration crops like castor. As castor is grown allowing a wider spacing of 180 cm, growing of greengram as an intercrop would provide an additional income to the farmer, besides providing nutritious fodder to the animals.

A technology demonstration on inter cropping of castor with greengram was conducted at Gander during *kharif* 2009 in 2: 4 ratio (Figure 28). With intercropping, castor produced a yield of 1020 kg ha⁻¹ and green gram 285 kg ha⁻¹. The farmer obtained a net return of Rs. 27,520 per ha under the inter cropping system, against Rs. 11,140 and Rs.13,500 per ha under sole crop of green gram and castor respectively. The system recorded a BC ratio of 2.57 whereas sole crops of castor and greengram recorded BC ratio of 1.96 and 2.17, respectively (Figure 29). The intercropping system was appreciated by the farmers in the vicinity as well.



Fig 28. Castor + green gram intercropping at Gander

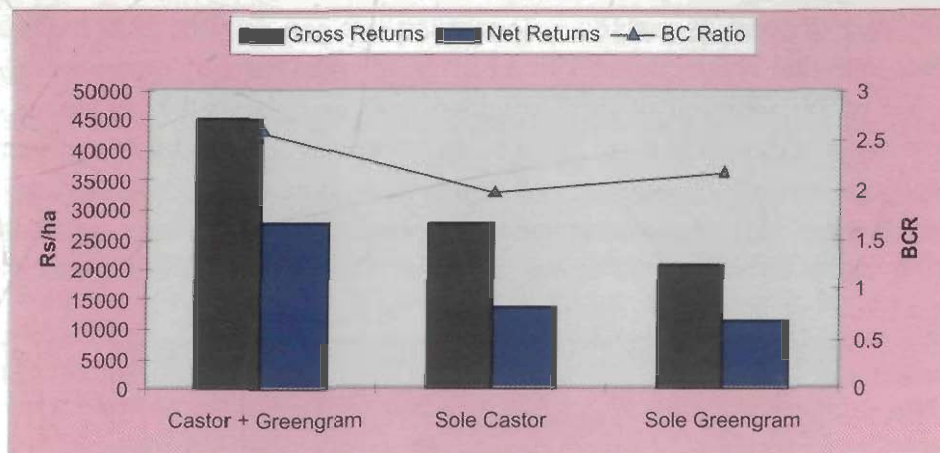


Fig 29. Yield and economics of castor + greengram intercropping at Gander

4.4 Demonstration on pressurised irrigation

In arid and semi arid areas, the timings and amount of rainfall are highly variable and inadequate to meet the moisture requirement of crops. Scarcity and quality of water and growing competition for water in many sectors reduce its availability for irrigation. Effective management of water for crop production in water scarce areas requires use of efficient and integrated approaches of water management.

Kachchh being located in the hot arid region of the country suffers from the quantity and distribution of rainfall, which is grossly inadequate and highly erratic. The farmers of the region utilise ground water for irrigation. The over exploitation of groundwater from deeper and deeper strata is causing the depletion of scarcely available ground water and salination of the area, leading to complete degradation of two precious natural resource namely water and soil. To address these issues, technological demonstration on pressurised irrigation comprising of drip system was undertaken at village Kotda and Tharawda in Kachchh during *khariif* 2009 (Figure 30).

The test crop was cotton varieties Vikram-5 and 151. Row to row distance of lateral was maintained at 180 cm with 60 cm dripper spacing. The dripper discharge rate was 4 ltr hr⁻¹. The irrigation was scheduled at alternate day as per prevailing temperature. The nitrogenous fertiliser through urea was applied as fertigation. The system was compared with usual practice of flood irrigation. In flood method farmers were giving 25-30 irrigations.

The crop under drip irrigation recorded an average yield of 3.5 t ha⁻¹ which was 8.4% higher than that obtained under flood irrigated crop. Farmers on an average gained Rs. 6066 per ha by adoption of drip irrigation over and above the net return obtained under flood irrigated cotton (Figure 31). The BC ratio was 2.48 under drip system against 2.41 under flood system. By adoption of drip system there was 43.4% increase in water use efficiency. The reduction in water use by drip method was 56.7 cm over flood method of irrigation and a saving of 30% was achieved with regard to nitrogenous fertiliser application.



Fig 30. Cotton under drip irrigation in Tarawda

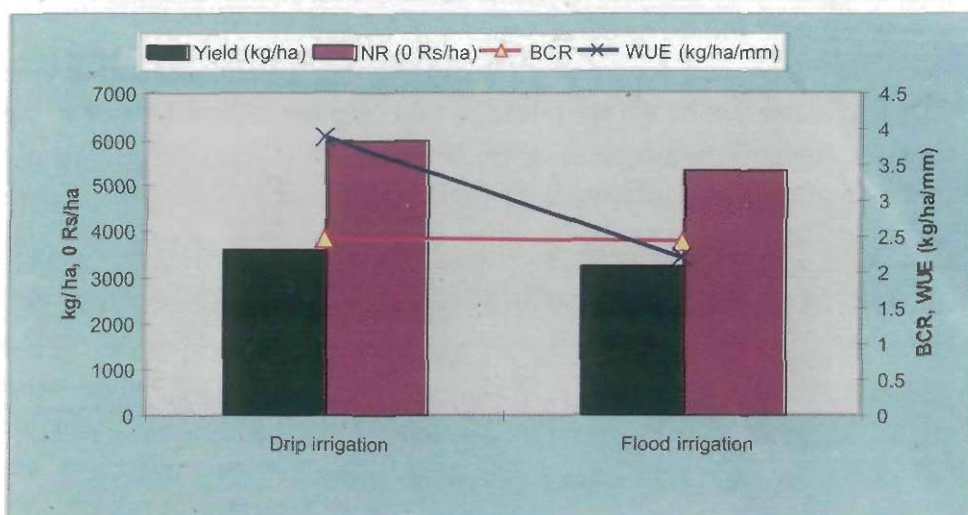


Fig 31. Yield and economics of drip and flood irrigations in cotton under farmer's field

4.5 Demonstration on improved cultivation of ber

The entire area of Kachchh district of Gujarat is under arid zone, where low and erratic rains, extremely high temperature coupled with high evaporative demands restrict the growing period of agricultural crops and make production unsustainable. Under these situations, horti-based systems are more sustainable and economical. Ber is known for its hardy nature and gives sustainable production under arid condition. To popularise the ber cultivation in Kachchh region of Gujarat, technology demonstrations were carried out in farmer's field. In 2008 and 2009, demonstration on improved cultivation ber was carried out in villages Tharawda, Gander, Dhaneti and Kotda. For each farmer, 25 saplings of ber were given (12 saplings of variety, Gola and 13 saplings of Seb) (Figure 32). All the technologies, starting from field preparation, digging of pits, training and pruning were advocated to farmers.

The variety Gola is an early variety (fruiting starts by the end of December in Kachchh) and is a juicy variety with less keeping quality whereas Seb is a late variety in which fruiting starts by last week of January in Kachchh. Both are high yielder with average yield of 40-50 kg tree⁻¹ under rainfed and 80-100 kg tree⁻¹ under irrigated conditions. The planting distance recommended was 6 x 6 m so as to accommodate 277 plants per ha. The budded plants of ber were directed to plant in pits of 60 x 60 x 60 cm, filled with a mixture of top soil, FYM (@10 kg pit⁻¹) and endosulfan (@50g pit⁻¹). For initial two months irrigation was recommended to be given at 4-5 days interval, if adequate rainfall is not received. The farmers were given adequate demonstrations on pruning and training of the plants to build strong architecture of branches to bear heavy load of fruits. There was about 75-80% survival of the plants in technology demonstrations. Any flower appearing in the first three years is advised to be removed. There was appealing growth of ber plants in the farmer's field.



Fig 32. Technology demonstration on improved cultivation of ber at Dhaneti and Kotda.

The technology of improved cultivation ber was frequented by large number of farmers and there were overwhelming response and queries from farmers from all the

participating villages for the technology and availability of plant materials for large scale adoption. In response to the demands by different farmers, one day training on improved cultivation was organised at CAZRI, Regional Research Station, Kukma- Bhuj on 1st January 2010, to provide technical knowledge on cultivation and post harvest management in ber. The training was attended by about 100 farmers from all the five FPARP villages and the village Kukma (Figure 33).



Fig 33. Training on improved cultivation of ber at RRS, Kukma on 1st January 2010

4.5 Demonstration on rodent control

The rodents are main threat for arable cropping in arid zone. They cause damage to the crops both in field as well as in storage. In realisation of extensive damage caused by rodents in arid agriculture, the technology demonstrations on rodent control were carried out in villages Kotda, Tharawda, Khambhra, Dhaneti and Gander. Totally twenty demonstrations were carried out in 2008-09 and 2009-10. Proper training and guidance were imparted to the farmers in their field, regarding pre-baiting, preparation and application of rodenticides (Figure 34). The rodenticides were applied at sowing in *kharif* and after harvest of *rabi*. The farmers experienced a significant reduction in rodent population and thus, reduced damage in field crops.



Fig 34. Demonstration on preparation and placing of rodenticidal bait at Gander

કચ્છમિત્ર

જાન ૧૧ • મોડે ૧૯૯૧ • એન. નં. ૨૧ • સંસ્કૃત • નં. ૩૧/૦૧/૯૧ • કિલો ૧૬.૫૦



'કાઝરી' દ્વારા ખેડૂતોને ખોરની ખેતીની શક્તિની આપવા કુચવાદે યોજાયેલા કાર્યક્રમમાં સ્વચ્છતા અને આજીવનિકાના નાયબ નિયામક શ્રી મોડ, સંસ્થાના વડા ડૉ. ઉપાધ્યાય તથા અન્ય તજજ્ઞો. ડૉ-એચ.આર્. ઝુલખે ઝુલખે લાખી પોસ્ટા ખોરની શક્તિની મેળવણી રહેલા કિસાનો. (નસરીર - હરષદ જોડાણ)

ખોરની ખેતી શીખી નવા વર્ષનો આરંભ

મુજ, તા. ૧ : ૨૦૧૦ના આરંભે જ કાઝરીના આયોજવામાં ઉંચે અને મજાબમ ઉત્પાદન માટે અનુકૂળ એવા ખેતરોમાં ખોરની ખેતમ ખેતી કરી રહે છે. તેની જેમી કોઈપણ તરફથી આજીવનિકાના નાયબ નિયામક શ્રી મોડે, સંસ્થાના વડા ડૉ. ઉપાધ્યાય તથા અન્ય તજજ્ઞો. ડૉ-એચ.આર્. ઝુલખે ઝુલખે લાખી પોસ્ટા ખોરની શક્તિની મેળવણી રહેલા કિસાનો. (નસરીર - હરષદ જોડાણ)

'કાઝરી'એ ધોણેલી શિબિરમાં
પાંચ ગામના કિસાનો જોડાયા :
કિસાનો કાર્યનો લાભ લેવા હકેક

આજીવનિકાના નાયબ નિયામક શ્રી મોડે, સંસ્થાના વડા ડૉ. ઉપાધ્યાય તથા અન્ય તજજ્ઞો. ડૉ-એચ.આર્. ઝુલખે ઝુલખે લાખી પોસ્ટા ખોરની શક્તિની મેળવણી રહેલા કિસાનો. (નસરીર - હરષદ જોડાણ)

કે. આજીવનિકાના નાયબ નિયામક શ્રી મોડે, સંસ્થાના વડા ડૉ. ઉપાધ્યાય તથા અન્ય તજજ્ઞો. ડૉ-એચ.આર્. ઝુલખે ઝુલખે લાખી પોસ્ટા ખોરની શક્તિની મેળવણી રહેલા કિસાનો. (નસરીર - હરષદ જોડાણ)

ખેરમાં પાણીની જરૂરત વધી જણાવતે કરી હતી. જેને આજીવનિકાના નાયબ નિયામક શ્રી મોડે, સંસ્થાના વડા ડૉ. ઉપાધ્યાય તથા અન્ય તજજ્ઞો. ડૉ-એચ.આર્. ઝુલખે ઝુલખે લાખી પોસ્ટા ખોરની શક્તિની મેળવણી રહેલા કિસાનો. (નસરીર - હરષદ જોડાણ)

કચ્છમિત્ર

KUTCHMITRA • BHUJ • 02.07.01 • THURSDAY

ખરીક પાકના બિયારણના વિતરણ નિદર્શન માટે 'કાઝરી' સંજ્ઞ

મુજ, તા. ૧ : સંસ્થાના નાયબ નિયામક શ્રી મોડે, સંસ્થાના વડા ડૉ. ઉપાધ્યાય તથા અન્ય તજજ્ઞો. ડૉ-એચ.આર્. ઝુલખે ઝુલખે લાખી પોસ્ટા ખોરની શક્તિની મેળવણી રહેલા કિસાનો. (નસરીર - હરષદ જોડાણ)

કચ્છમિત્ર

KUTCHMITRA • BHUJ • 31-12-00 • THURSDAY • નં. ૧૧ • મોડે ૧૨૮ • મુજ • Regd. No. G. RCH-2200-2001

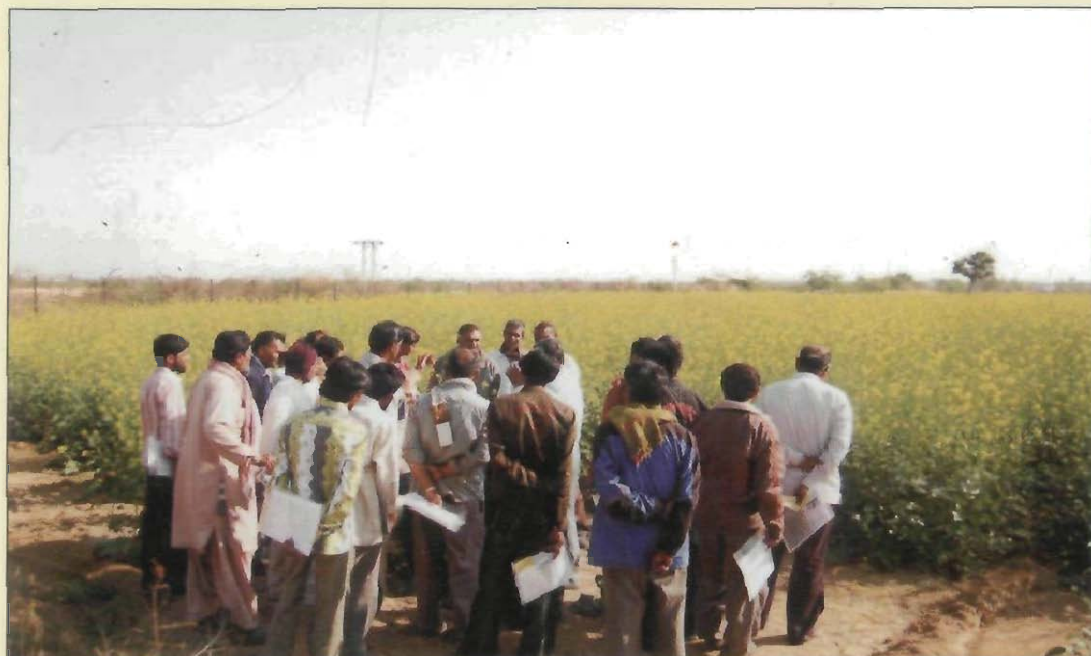
કાલે 'કાઝરી' દ્વારા ખેડૂતો માટે તાલીમ શિબિર યોજાશે

મુજ, તા. ૩૦ : કચ્છ જેવા સુકા પ્રદેશની આબોહવાને માકક આવે એવા ખોરની સુધારેલી જુલની ખેતી માટે ખેડૂતોને માહિતગાર કરવા કુચમા નજીક આવેલી કેન્દ્રીય શુષ્ક વિસ્તાર અનુસંધાન કેન્દ્ર (કાઝરી) દ્વારા ૧ જાન્યુઆરીના એક દિવસીય તાલીમ શિબિર આયોજન કરાયું છે. કાઝરી સંકુલમાં આયોજિત આ તાલીમ કાર્યક્રમનું સંસ્થાના નાયબ નિદેશક (આગ્રાપત) ડૉ. એ. કે. મોડના અધિવેશનમાં ઉદ્ઘાટન કરાશે. આ કાર્યક્રમમાં પાંચ ગામના ૨૦૦ જેટલા ખેડૂતો જોડાશે એમ સંસ્થાના વડા ડૉ. ઉપાધ્યાયે જણાવ્યું હતું.

News coverage of activities under Farmer's Participatory Action Research Programme in Kachchh, Gujarat



Farmers assisting in taking observations on ber



A field day of farmers to the technology demonstration, on improved variety and INM in mustard during rabi 2009