

Agricultural Research Station, Bikaner

Agricultural Research Station, Bikaner was established in 1997 to cater research and extension needs of Agro-climatic zone Ic (Hyper arid partially irrigated western plain) of Rajasthan. Zone occupies an area 7.71 mha geographical area spread over Bikaner, Jaisalmer district and Sardarsahar, Ratangarh, Bidasar and Sujangarh tehsils of Churu district.

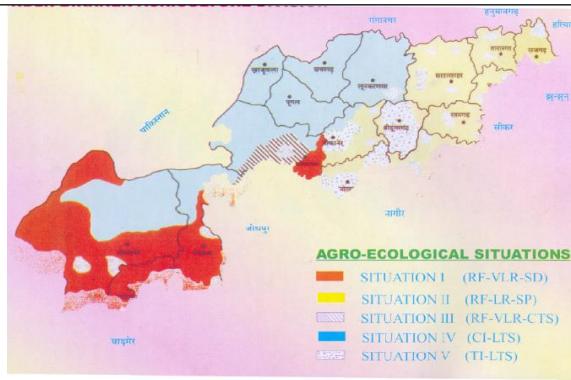
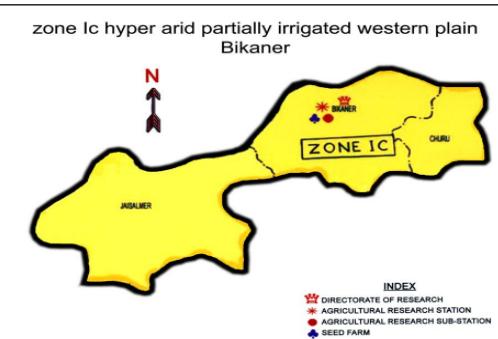


Agricultural Research Station, Bikaner is situated in the state of Rajasthan and located on National Highway No. 15 leading towards Sriganganagar about 9 km away from Bikaner city. It is situated at 28°10' N latitude, 73°18' E longitude and 223.88 meter above mean sea level. It is just 3 km away from the University head quarter.

About the Zone:

The average rainfalls vary from 141 mm in Jaisalmer to 325 mm in Churu. The mean daily maximum temperature goes up to 42° C during summer and 24° C during winters. Similarly, mean daily minimum temperature during summers come down to 27° C and to freezing point during winters. The area is characterized by stormy southwest winds with frequent dust storms. 70 per cent cultivated area is rainfed. Crop production in this part gambles with monsoon. Soils of the zone are sandy in texture, very low in fertility with respect to all most all nutrients. Soils are aeolian in nature with very high permeability at surface and low in nutrient and water retention capacity. Considerable area under the zone has hard pan at varying depths. Some soils of the zone are gypsiferous also.

The major kharif crops of the zone are pearl millet, moth bean, cluster bean & sesame under rainfed condition and ground nut under irrigated conditions. In rabi chickpea, mustard, wheat are the major crops.



MISSION	
Agricultural Research Station, Bikaner has the mandate to develop and identify high yielding varieties, sustainable production and protection technologies for improving the productivity of the crops through research on below mentioned lead and verification functions.	
Lead Functions	
Management of salt affected soils and water, crop improvement in forage crops, arid legume crops, pearl millet, groundnut, and date palm, biotechnological approach for improvement of arid crops, weather forecasting, insect pest and disease surveillance.	
Verification Function	
Precision farming of horticultural crops, mustard, wheat, barley, chickpea and medicinal plants, cotton, moongbean, etc. Station is having well furnished buildings with different laboratories -Salinity, STCR, PFDC, Forage, Date palm, Groundnut and Plant Protection lab. These laboratories are equipped with modern equipments. Conference hall and scientists rooms well connected with intercom and internet facility are also exists. Station is also having 94.25 ha well developed farm. About 50 ha. area is canal irrigated. Station is having 10 ha farm area under orchards of ber, anola, lime, pomegranate, kinnow, mousambi & malta. All the modernized farm machinery is available to perform different farm works. Twenty nine residential quarters are available at the residential campus just in front of the station.	
Schemes/Projects	
Priorities & Thrusts	
<ol style="list-style-type: none"> 1. Germplasm collection, characterization, evaluation, conservation & utilization of moth bean, pearl millet, forage grasses and date palm. 2. Breeding to develop improved varieties of moth bean, pearl millet, groundnut and forage grasses for higher yield and biotic and abiotic stress. 3. Development of integrated nutrient management & integrated pest and disease management module of major crop and cropping system. 4. Research in precision farming specially water saving technique of major field & horticultural crops. 5. Exploring possibility of protected cultivation. 6. Development of new improved package of practices for enhancing productivity of major crops of the zone. 7. Developing weed control technologies to control weeds in major crops and cropping system of the area. 	

Research Achievements

Pearl millet

	<ul style="list-style-type: none">1. In comparison to pure pearl millet, sowing of 75 % pearl millet +25 % guar+ 25% mothbean in mixture with 40 kg N gave more pearl millet equivalent yield and profit.2. 5 tons FYM spreading over planted rows of pearl millet gave significantly higher yield and net return of pearl millet and combats the crust problem very well.3. Sowing of pearl millet at 60 cm row spacing with ridge and furrow after intercultural operation (30DAS) gave significantly higher yield, net return and B: C ratio under stress conditions of western part of Rajasthan.4. Pearl millet can be raised with water having RSC around 10me/l using sprinkler system along with application of 10t FYM/ha and gypsum in soil equivalent of 5.0 me/l RSC under sandy course textured soils.5. Intercropping of caster with cluster bean in 1:2 ratio gave the highest caster equivalent yield.
	<ul style="list-style-type: none">6. Hybrid variety Pusa-605 has been found suitable for cultivation in this zone. It has maturity period of 75-80 days and gives average yield of 9-10 q/ha.7. Soil application of gypsum @ 50 % GR and equivalent to partial neutralization (up to 4 me/L) of high RSC water is recommended for pearl millet.8. Fertilizer prescription equations based on soil test crop response for targeted yield of pearl millet grown under irrigated as well as stress condition were developed.9. Pearl millet- guar crop sequence has been found to be better than pearl millet-pearl millet crop sequence and gave more pearl millet equivalent yield and profit.10. 20 kg/ha. Zinc sulphate as a soil application gave significantly higher grain & straw yield of pearl millet as well as net return and B: C ratio as compared to control plot.11. In standing crop foliar spray of 0.2% Zinc sulphate at tillering stage gave significantly higher grain & straw yield of pearl millet as well as net return and B: C ratio.12. This is to be recommended that growing of pearl millet hybrids in zone 1c gave higher grain yield, net return and B: C ratio as compared to composite varieties on mean basis. This is also recommended that growing of pearl millet under optimum management condition gave higher grain and stover yield, net return and B: C ratio. as compared to low management conditions.

- 6. Hybrid variety **Pusa-605** has been found suitable for cultivation in this zone. It has maturity period of 75-80 days and gives average yield of 9-10 q/ha.
- 7. Soil application of gypsum @ 50 % GR and equivalent to partial neutralization (up to 4 me/L) of high RSC water is recommended for pearl millet.
- 8. Fertilizer prescription equations based on soil test crop response for targeted yield of pearl millet grown under irrigated as well as stress condition were developed.
- 9. Pearl millet- guar crop sequence has been found to be better than pearl millet-pearl millet crop sequence and gave more pearl millet equivalent yield and profit.
- 10. 20 kg/ha. Zinc sulphate as a soil application gave significantly higher grain & straw yield of pearl millet as well as net return and B: C ratio as compared to control plot.
- 11. In standing crop foliar spray of 0.2% Zinc sulphate at tillering stage gave significantly higher grain & straw yield of pearl millet as well as net return and B: C ratio.
- 12. This is to be recommended that growing of pearl millet hybrids in zone 1c gave higher grain yield, net return and B: C ratio as compared to composite varieties on mean basis. This is also recommended that growing of pearl millet under optimum management condition gave higher grain and stover yield, net return and B: C ratio. as compared to low management conditions.

13. It was recommended that application of 5ton FYM/ha in pearl millet did not cause any significant effect on mustard yield. Whereas, application of RDF+20 Kg K₂O +200 Kg Gypsum +10Kg ZnSO₄ /ha in mustard gave significantly higher seed yield, net return and B: C ratio over the control plot, but it was at par with RDF+20 kg K₂O/ha. This treatment also gave higher seed yield and net return among all the treatments.
14. The highest barley seed yield and barley equivalent yield was observed under the treatment compost 10 ton/ha. + 50% RDF. Similarly the gross and net return was also highest in the same treatment. Whereas, the B: C ratio was highest in the treatment 100% RDF, which is due to the fact that higher cost of organic manure was involved in that treatment
15. Application of RDF + 20 Kg K₂O/ha in previous mustard crop along with recommended dose of fertilizer (40:40:0) in pearl millet proved economical viable treatment and gave higher yield of mustard and pearl millet crops. This treatment gave higher net return in bajra-mustard crop sequence.
16. It was recommended that variety **GHB-538** is proved most drought resistant as compared to GHB-558 and gave higher yield and net return. Similarly, sowing of pearl millet at 60 cm prove better under different row arrangement and gave higher yield and net return as compared to other row spacing.
17. It was recommended that growing of pearl millet with 60 kg N/ha gave highest grain and Stover yield , net return and B: C ratio as compared to control plot and 40 kg N /ha.
18. It is recommended that sowing of pearl millet in 2nd week of July ie.15 July is the best sowing time and gave better economic return
19. Growing of hybrids gave more yield and higher net-return & B: C ratio as compared to the population. Although, population gave higher fodder yield as compared to Hybrids.
20. On the basis of three years data, It is recommended that for organic production of pearl millet under pearl millet – gram crop sequence, application of 7.5 t FYM/ha every year in Pearl millet crop gave significantly higher grain yield of gram / pearl millet over the control plot and lower dose of FYM and Vermi compost and similar trend was observed in straw yield also. This treatment also gave maximum pearl millet equivalent yield, net return and B: C ratio. This treatment is closely followed by 2.5 t FYM/ha + 1.0 t Vermi compost/ha.
21. Popularized the hybrid **RHB-177**, **MPMH-17** and **RHB-173** in Jodhpur, Nagaur Churu and Jaisalmer district of Rajasthan through HOPE, NFSM project and FLD during 2010-2017 in Western part of Rajasthan

Wheat

1. Post- emergence application of metsulfuron methyl @ 4.0 g/ha at 30 to 35 days after sowing is recommended for effective control of weeds in wheat crop. Hoeing and weeding by “cycle wheel hoe” (Wherever available) is also beneficial where crop is sown in lines.
2. Fertilizer prescription equations based on



<p>soil test crop response for targeted yield of wheat were developed.</p> <p>3. When two sources (saline and good quality) of water are available then for optimum yield of wheat two types of water should be mixed in such a proportion that the E.C. of mixed water does not exceed 3.75 dS/m.</p>	
<p>4. For controlling broad leaf weeds in standing wheat crop post emergence application of carfentrazone (SG) @ 20g/ha in 500 liter of water spraying in between the rows found effective.</p> <p>5. In wheat crop total depth of irrigation is kept as 42 cm, if canal water through sprinkler is used for irrigation. No increase in yield was observed above this depth.</p> <p>6. If ECiw of irrigation water is around 3.0 dS/m, the total depth of irrigation water should be 38.0 cm. For ECiw of 4.5 dS/m the total depth of water should be kept as 35 cm for maximizing crop yield. Crop yield decreased drastically beyond this depth.</p>	

Barley

- Under balanced fertilization management system, soil test crop response equations for N, P and K along with organic manures were developed for obtaining targeted yields of barley
- Highest seed yield was observed under application of compost @ 10 ton/ha. +50%RDF .It was also observed that highest barley equivalent yield (q/ha.) was recorded under this same treatment. Similarly the gross and net return were also highest in this treatment.

Mothbean

<p>RMO-225 (Maru Vardan): This short duration variety (64-67days) gives 6-7.5 q/ha seed yield and has good resistance against yellow mosaic virus. It was released in 1999 for all moth-growing areas of the country.</p>	
	<p>RMO-435: This short duration variety matures in 67-70 days giving 6-8 q/ha yield and also has fodder value. It was released in 2001 for all moth-growing areas of the country.</p>
<p>RMO-257: This early maturing variety (65 days) is high yielding for</p>	

<p>grain as well as fodder purpose. Its flowers are in clusters with small petiole and plants are spreading type. It was identified and released in 2002 in Rajasthan state for all moth-growing areas.</p>	
	<p>RMO-423: This variety was released in 2002 in Rajasthan state for all moth-growing areas. The variety is suitable for both seed and fodder purpose. It matures in 67-70 days. This is resistant to yellow mosaic virus and insect pests.</p>
<p>RMB 25 (RMo 2004): This variety was released in 2004 in Rajasthan state for all moth-growing areas. It gives higher seed yield (28.6%) as well as fodder yield (15.4%) than RMO-225 and RMO-257, respectively. The variety has field resistance to yellow mosaic virus and also has high protein content.</p>	
	<p>RMO-2251 (Marudhar): This variety has been released during 2016 for release in Rajasthan. It is a short duration (63-67 days) and has good resistance against sucking pests like jassid and white fly.</p>
<ol style="list-style-type: none"> 1. Fluchloralin @ 1.0 kg/ha as pre-planting incorporation for effective weed control in mothbean. 2. Seed soaking in 500 ppm thiourea with two foliar sprays of thiourea (500ppm) at vegetative and flowering stages was found effective for obtaining higher seed yield of mothbean 3. RMO – 225, RMO – 435 and RMO – 423 varieties of mothbean have been recommended for cultivation in the zone. 4. Fertilizer prescription equations based on soil test crop response for targeted yield of moth were developed. 5. In mothbean the control of Jassids, Thrips and whiteflies through dusting of fenvelrate 0.4% and methyl parathion were found superior. 6. Maximum yield of mothbean was achieved with three sprays of monocrotophos (0.04 	

- per cent) against losses due to major insect pests.
7. Mustard/groundnut/sesamum oil @ 8 ml per kg proved most effective whereas upper sand layer placement @ 4 cm thickness proved most effective in controlling losses due to bruchids during storage in mothbean.
 8. Intercropping of early maturing mothbean varieties with pearl millet in 3:1 ratio is more remunerative
 9. Planting of mothbean in western Rajasthan should be done next day of the effective rainfall (30-40 mm) in second fortnight of July month.
 10. Moth bean performed significantly better with the row spacing of 30 cm and fertility level 20 kg N and 40 kg P₂O₅ over row spacing of 45cm and fertility level of 10 kg N and 20 kg P₂O₅.
 11. For organic production of moth bean, foliar spray of cow urine (10 %) + neem leaf extract (5 %) was most effective in managing YMV of moth bean.
 12. For raising organic moth, application of 100 % FYM equivalent to 100 % RDF (20 Kg N/ha) + PP through neem based products/other organic products was found most effective. It was closely followed by application of FYM equivalent to 50 % RDF (10 Kg N/ha) + 50 % of RDF (10 Kg N/ha) through decomposed crop residue/organic waste + bio-fertilizer + PP through neem based products/other organic extracts.
 13. Under organic intensive approach for raising moth bean, application of 100 % of RDF (20 Kg N/ha) through FYM + bio-fertilizer + PP (BCA) + gypsum + green manure/crop residue + cakes + need based chemical through foliage application only gave higher seed yield and economic returns in moth bean .
 14. Moth bean sown on the residue of 10ton compost/ha. +50% RDF applied in previous barley crop gave highest moth bean equivalent yield and net returns under barley –moth bean crop sequence.

Moongbean

1. Fluchloralin weedicide should be used @ 0.75 kg/ha (a.i.) for weed control in moongbean crop. The amount should be dissolved in 500 liters of water and the solution should be used as pre-planting incorporation in soil. One to two weeding and hoeing operations by wheel hoe (wherever available) should be done in the crop sown in row after first irrigation
2. Application of 40 kg sulphur through gypsum was found beneficial in obtaining higher yield and quality of moongbean.



Chickpea

1. In chickpea crop pre-plant incorporation of fluchloralin @ 0.75 kg/ha in 500 liter of water followed by one hand weeding 30 days after sowing recommended for controlling weeds.



2. Emamectin benzoate 0.4 kg/l found most effective for the control of pod borer in gram crop or alternatively Indoxacarb 200 ml/h can be taken for the control of pod borer in gram crop.
3. In gram application of 40 kg sulphur per hectare through gypsum was found effective

Mustard

1. Mustard can tolerate sodic waster up to RSC of 4 m. e. therefore, gypsum equivalent to RSC of water more than 4 m.e. should be added to soil before the sowing of crop. For each milli equivalent (m.e.) of RSC neutralization about 90 kg of gypsum per irrigation per hectare is required.
2. For controlling *Orobanche* in mustard crop, application of 200 kg/ha neem cake in furrows at the time of sowing and pre-emergence spray of pendamethalin at 0.5 kg a.i./ha in 500 liter of water followed by one hand weeding at 60 DAS found effective and it reduced the *Orobanche* infestation and gave higher yield.
3. On the basis of experimentations on mustard crop with varying levels of nitrogen, phosphorus and potassium with organics fertilizer adjustment equations were developed using Ramamoorthy's inductive approach.

Groundnut

1. **TBG- -39 (Trombay Bikaner groundnut 39).** This virginia bunch type groundnut variety has been developed under the collaborative efforts of Bhabha Atomic Research Centre, Trombay and Rajasthan Agricultural University, Bikaner. This variety has large pod size with bold seeds (66g/100 seeds). It matures in 116 days with high haulm yield, shelling per cent (64 %) kernel weight (66 g) and harvest index (41 %). This variety possesses good degree of tolerance to stem rot as well as chlorosis. The average pod yield is about 12-20 per cent higher over prevalent check varieties.
2. For control of grassy weeds in groundnut post emergence application of quizalofop ethyl 5 EC @ 1 liter/ha. 20-25 days after sowing in 500 liters of water was found effective.
3. Groundnut variety **TG 37A** recommended for cultivation in the zone.
4. On the basis of experimentation on Groundnut with varying levels of nitrogen, phosphorus and potassium under IPNS fertilizer adjustment equation were developed using targeted yield approach: These equations was verified at five locations in farmers fields and these equations can be used by the soil testing



laboratories or farmers having soil test data for fertilizer recommendation for groundnut crop.

5. A bold seeded groundnut variety TBG-39 medium maturity (116 days) requires 6-8 irrigation during the crop season, saves water up to 40%. It has produced yield of more than 32 q/ha. sowing in first to second week of July has been recommended for cultivation in zone Ic

Fenugreek

1. To obtain maximum yield of fenugreek water may be applied @ 0.6 V through drip along with the use of 25 micron black plastic mulch. The average seasonal water requirement of fenugreek crop under drip & mulch has been worked out to be 282 mm under arid conditions. In without mulch drip irrigated fields water may be applied @ 1.0 V i.e. 430 mm to obtain higher yields of fenugreek.
2. Fenugreek should be sown during first fortnight of November in the mean temperature range of 23-24 °C in the agro climatic zone 1c when crop accumulates about 1800-1900 day °C heat unit with the application of 40 kg P₂O₅ ha⁻¹

Cumin

1. Under balanced fertilization management system. soil test crop response equations for N, P and K along with organic manures were developed for obtaining targeted yields of Cumin

Fennel



1. Under balanced fertilization management system. soil test crop response equations for N, P and K along with organic manures were developed for obtaining targeted yields of fennel.
2. In fennel crop pre plant incorporation of trifluralin at 0.75 kg ai/ha in 500 liters of water + one hand weed at 60 days after sowing was found economically viable for managing almost all the seasonal weeds.
3. To obtain maximum yield of fennel water may be applied @ 0.6V through drip along with the use of 25 micron black plastic mulch. The average seasonal water requirement of fennel crop under drip and mulch has been work out to be 343 mm under arid conditions. In without mulch drip irrigated fields water may be applied @ 1.0 V i.e. 536mm to obtain higher yields of fennel.

Isabgol

1. Under balanced fertilization management system, soil test crop response equations for N, P and K along with organic manures were developed for obtaining targeted yields of Isabgol
2. Application of isoproturon at 0.5 kg a.i./ha as pre-emergence in isabgol effectively controlled the season weeds.



Cotton

1. Under balanced fertilization management system, soil test crop response equations for N, P and K along with organic manures were developed for obtaining targeted yields of cotton.

Clusterbean

1. Seed soaking in 0.05% thiourea followed by two sprays of thiourea (0.1 %) at 25 and 45 days in cluster bean has been found effective in increasing seed yield.
2. For weed control in guar crop, fluchlralin weedicide should be used @ 0.75 kg/ha (a.i.) as pre planting in corporation in soil. One to two weeding and hoeing operations by wheel hoe (wherever available) should be done in the crop sown in row after first irrigation.
3. For the use of high RSC water in calcareous soils, mixing of pyrite @ 50% GR in soil 20 days before sowing or two sprays of 2% FeSO₄ + 0.1% citric acid at 25 and 35 days after sowing are recommended for highest yields of clusterbean. If available easily, pyrite is more beneficial.
4. Irrigation water having RSC upto 4.0 me/L was found safe for irrigation in clusterbean under light textured soils provided that gypsum is added to soil as per 50 per cent GR.
5. On the basis of experimentation on clusterbean with varying levels of nitrogen, phosphorus and potassium under IPNS following fertilizer adjustment equation were developed using targeted yield approach: Equations developed for cluster bean were tested at ten sites through front line demonstrations in the farmers fields. These STCR recommendations are beneficial and economical.
6. Maximum yield of guar was achieved with three sprays of monocrotophos (0.04 per cent) against losses due to major insect pests.
7. In clusterbean seed treatment with streptocycline (1g/kg) along with 3 sprays of streptocycline (150 ppm) at an interval of 15 days starting from appearance of bacterial blight disease were most effective in reducing disease intensity.
8. Neem based products viz. NSKS, NLE and cow dung also showed effectiveness in controlling the bacterial leaf blight of clusterbean
9. Bio-efficacy of different insecticides and botanicals against insect pest of guar proved that the treatments phosphamidon 0.03 per cent and monocrotophos 0.04 per cent

proved most effective and botanical NSKS 5.0 % is also effective.

10. For management of sucking insect-pests of cluster bean one spray of thiamethoxam 25 WG @ 0.0084 % or imidacloprid 17.8 SL @ 0.005 % or Acetamiprid 40 SP @ 0.004 % or Carbosulfan @ 0.05 % were found equally effective.

Horticultural Crops

Datepalm

1. Thirty four cultivars of datepalm are being maintained at the centre.
2. Datepalm cultivar Halawy Barhee, Khune izi and Zahidi is recommended for fresh fruit whereas Medjool is recommended for dry dates (chhuhara) in Bikaner region.
3. Thinning of datepalm bunches after fruit set (1/3 rd portion from the center) help in early ripening and also improves physico-chemical characteristics of fruit of Halawy variety.
4. Pre harvest application of ethrel @ 1000 ppm at colour break stage in Medjool variety hastens ripening of fruit and also increases size and weight of fruit.
5. Mulching of tree basin from the trunk to canopy area of the tree by black polythene sheet or 10 cm thick layer of locally available weed 'Bui' (*Aervo Persica*) help in better soil moisture retention suppresses weed growth and better soil moisture retention and improves fruit quality.
6. Application of 1500 g nitrogen per palm per year with 500 g each phosphorus and potash as basal doses to cultivar Halawy gives optimum yield and growth of fruit. 60 percent nitrogen should be applied before one month flowering and rest 40 per cent at fruit set.
7. Fruit bunch and leaves ratio should be 1:6 as it gives optimum fruit quality and yield of Medjool variety.
8. Application of 50% NPK+Biofertilizer +FYM (750g N, 125 g P, 125 g K and 50 g S + 125 g Azatobacter and 50 g PSB + 25 Kg FYM) in 10 year old plant of date palm is found effective to increase yield and quality characteristics of the fruit.
9. Foliar application of micronutrients FeSO₄ (0.5%) + Thiourea (0.1%) just after fruit setting is found effective to increase the yield and quality characteristics of the fruits.
10. At the time of transplanting off shoot (suckers) of datepalm must be treated with carbendazim 0.1% + Chlopyrifos 0.1% Indole Butyric acid 1000 ppm with alternate day irrigation up to 30 days is effective for better survival and establishment of date suckers.



- Survival of datepalm suckers is better in spring season (February to March) plantation as compared to rainy season (September to October) plantation at Bikaner.
11. For Integrated management of fruit rots two sprays of carbendazim 0.1% + date leaf cover at the interval of 15 days was effective to control the fruit rots to 64.66 per cent and minimize yield loss (33.23%) as compared to control.

12. Two sprays of copper oxychloride (0.4%) at interval of 20 days were found effective in minimizing the Graphiola leaf spot disease by 65.96 per cent over untreated check.
13. Two sprays of carbendazim +mancozeb (0.2%) at the interval of 15 days found effective to control *Alternaria* leaf spot disease and to increase the yield.
14. For control of insect *parlatoria blencharidii* (scale insect) spray of Acetamiprid (0.3 ml/lt. water has been found effective.



15. For management of lesser datemoth (*Batrachadra* sp.) two sprays of endosulphan (0.07%) starting from fruit setting and repeated at 15 days after first spray has been found effective to control the lesser date moth and to increase the yield of fruits.
16. For control of scale insect (*Parlatoria blencharidii*) release of predatory beetle *Chilocorus nigritus* @ 10 beetles per palm is quite effective

17. On an average, 50 kg of doka fruit per year per tree can be harvested up to the age of 10 years and thereafter 75-100 kg per tree per year.
18. For preparation of dry dates (Chhuhara) full doka fruits (cvs. Medjool) should be washed and dipped in boiling water for 5-10 minutes and dried either in air circulating oven at 48° – 52° C for 70-95 hours or through sun drying from 80-120 hours if the weather is dry.

Cabbage

1. Under drip irrigation system, water should be applied @ 0.50 l/day/plant along with the application of 0.25 u black plastic mulch for higher yield of cabbage. In case plastic mulch is not available, water should be applied @ 0.90 l/day/Plant. A sowing of 44 % of water has been observed in drip irrigation as compared to surface (traditional) method of irrigation.
- 2.

Tomato

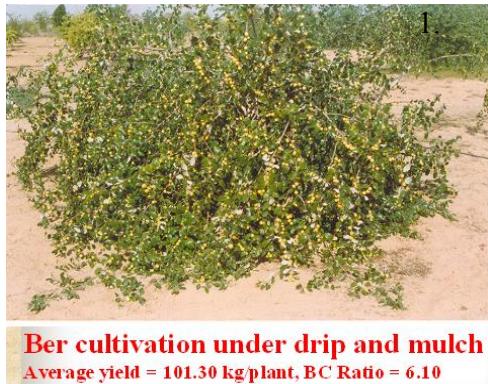
1. Average water requirement of tomato crop under drip irrigation system has been worked out to be 1.80 l/day/plant alongwith use of 25 micron black plastic mulch. About 40% water saved can be used for other purposes. As compared to surface irrigation, under drip irrigation system, 86.50 and 74.10% higher yields can be obtained with and without application of mulch, respectively.



2. It is recommended that under drip irrigation system, planting of tomato crop should be

done at the distance of 45 cm x 45 cm, having four plants per dripper in paired rows, with 120 cm lateral and 90 cm dripper spacing. The proposed system accounts for 27.5 per cent reduction in the cost of drip system in comparison to traditional recommendations.

Ber



Average water requirement of ber under drip irrigation system has been worked out to be 25.41 l/day /plant along with use of 100 micron black plastic mulch and 42.35 l/day/plant without use of mulch, depending upon crop stage and season. About 40% water saved by using black plastic mulch, can be used for other agricultural purposes. As compared to surface irrigation, under drip irrigation system, 37.5 and 21.2% higher yields can be obtained with and without application of mulch, respectively.

Bottle guard

Irrigating bottle guard with saline water up to 3.0 ds/m through drip was found safe under light textured soil conditions.

Okra

Okra can be successfully cultivated with water having EC up to 3.0 dS/m in coarse textured light soil under drip irrigation.

Kinnow

Schedule of drip irrigation in kinnow and sweet oranges from 1st year to 6th year crop was developed. Average daily water requirement of 30.47 lit./day/plant was worked out when the crop was irrigated at 0.8 volume of water. Based on the data of previous years the following daily irrigation schedule for drip irrigation is proposed for kinnow & sweet orange growers of arid region.

Forage crops:

Raj Bajra-1 (RBB-1)

1. Released at state level in 2015 for whole Rajasthan. Approximately 500 q/ha green fodder yield. Crude protein is 9.33 %. Green fodder yield productivity per day: 7.17 q/ha. Seed yield: Approx. 15 q/ha. Good resistance to all insect pests and diseases.



Bikaneri Dhaman (RCCB-2)



1. Released at state level in 2015 for whole Rajasthan. From one cutting 130 q/ha green fodder yield is obtained. Crude protein is 9.00 %. Good resistance to all insect pests and diseases. Perennial in nature and can be established by seed or rooted slips. Six cuttings can be taken in one year with irrigation.

Jaisalmeri Sewan (RLSB-11-50)

1. Released at central level in 2016 for North-West zone of India. Approximately 170 q/ha green fodder yield is obtained. Crude protein is 6.59 %.
2. Good resistance to all insect pests and diseases.
3. Perennial in nature and can be established by seed or rooted slips. Four cuttings can be taken in one year with irrigation.
- 4.



5. Krishna(RRB-07-1)



1. Released at central level in 2016 for North-West zone of India. 350 q/ha green fodder yield under annual condition in North-West zone of India. Under perennial condition (three years), it gives approx. 1800 q/ha green fodder yield on all India basis. Crude protein is 20.57 %. Good resistance to all insect pests and diseases.

Sorghum

Foliar spray of ferrous sulphate (0.5%) applied on re-growth of foliage after first cutting i.e. first at 15 days of cutting and 10 days thereafter corrected yellowing of leaves and significantly increased green fodder yield of sorghum.



Pearl millet

For getting higher green fodder yield of pearl millet, nitrogen should be applied @ 120 kg/ha in three split doses I.e. 1/3 basal + 1/3 top dresses at 20 day after sowing (DAS) + 1/3 at 35 DAS.

Oats

1. Two sprays of thiourea (0.05 %) at tillering and flowering improve seed production.
2. For higher economic returns, oat crop should be left for seed production after one cut for green fodder at 75 days after sowing. Fodder crop of oat should be fertilized with 120 kg N/ha in three split doses (1/3 as basal, 1/3 at 35 days after sowing and 1/3 after first cutting). October 10 to November 30 is the optimum period for sowing of fodder oat. Under good management, three cuts can be taken. The first cut should be taken at 75 DAS.

Lucerne

1. For lucerne, October 30 is optimum date of sowing. After first cut at 55-60 DAS, cuttings should be taken at three weeks interval.
2. For management of *Cuscuta (Amarbel)* and all seasonal weeds in lucerne crop application of pre-emergence pendimethalin at 1.0 kg a.i./ha as sand mixed or pre planting incorporation of Imazethapyr at 75 g/ha in 500 liters of water found effective.

Grasses

1. Foliar application of thiourea (0.05 %) at flowering improves seed production of *Lasurus indicus*. Nitrogen should be applied @ 20 kg/ha for getting higher seed production of *Lasurus indicus*.
2. Registration of Germplasm: IC number from National Bureau of Plant Genetic Resource, New Delhi were obtained for 35 germplasm accessions of *Cenchrus ciliaris* pasture grass. These accessions are being maintained. The IC numbers obtained are IC 551555 to 551589.
3. 350 lines of *Lasurus indicus* are being maintained and evaluated at the centre. 150 lines of *Cenchrus setigerus* are being maintained and evaluated at the centre. 90 lines of *Cenchrus ciliaris* are being maintained and evaluated at the centre.



Cropping System

1. For controlling seasonal weeds in wheat – bajra cropping system, post emergence application of metsulfuron methyl @ 4 g/ha in 500 litre water at 30 – 35 DAS in wheat and post emergence application of 2,4 D @ 0.5 kg/ha in 500 litre water at 20 – 26 DAS in bajra found suitable.

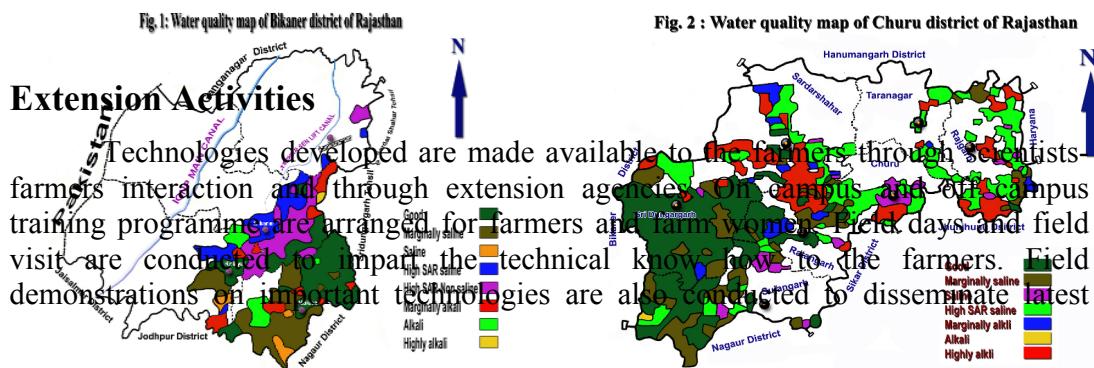
2. Mothbean sown on the residue of 10 t compost/ha + 50% RDF (90 kg N + 40 Kg P₂O₅) applied in previous barley crop gave highest mothbean equivalent yield and net returns under barley-mothbean crop sequence.
3. Pearl millet - guar crop sequence has been found to be better than pearl millet -pearl millet crop sequence and gives more pearl millet equivalent yield and profit.
4. Application of 10 t FYM per ha in both the season gave the highest net return. In case FYM is not available sufficiently, it should be applied at least in kharif season. It has been proved beneficial in Pearl millet - Oat - Cowpea sequence.
5. In pearl millet-mustard crop sequence, pearl millet crop fertilized with recommended dose of nitrogen and phosphorus and raised after mustard crop fertilized with 20 kg K₂O/ha gave higher grain and straw yield.
6. In moth bean -wheat cropping system, for the control of weeds in moth bean, pre-plant incorporation of fluchloralin @ 0.75 kg a.i./ha and in wheat, post-emergence application of metsulphuron methyl @ 4 g/ha was found effective and economically viable with no adverse effect on crops of the sequence.
7. Under food cum fodder crop sequence of pearl millet (food crop) + cow pea (fodder crop) -barley (food crop) application of 10 kg Zn through ZnSO₄ applied every year in addition to recommended dose of NPK gave higher green fodder yield of cow pea and grain yield of pearl millet and barley.
8. In pearl millet -mustard crop sequence, application of recommended dose of fertilizer (90:40:0) + 20 kg K₂O/ha + 200 kg gypsum/ha + 10 kg ZnSO₄/ha in mustard found effective over application of only recommended dose of fertilizers only.
9. In areas where fodder sorghum is grown, crop sequence of Sorghum (fodder) + Moth (grain) - Barley (grain) + Lucerne (fodder) may be followed. Use of FYM to meet 25% of nitrogen requirement of main crops along with bio-fertilizer (Rhizobium, Azotobacter and PSB) found beneficial with 50 % saving of chemical fertilizers.

Mixed Cropping

For higher forage production, pearl millet should be grown in combination with guar either in 1:1 or 2:2 row combinations and with cowpea in 2:2 row combinations.

Water Quality Survey and Characterization

Water quality maps of Bikaner, Churu and Nagaur districts have been prepared. To prevent formation of saline soil, water table should be maintained below 125 cm, however if the quality of water is good this value can be reduced to 100 cm.



technologies. The station is maintaining linkages with the line department viz department of Agriculture, GoR, ICAR institutes, located in the zone (CIAH, CAZRI), KVK, Bikaner for transfer of technology and to gather feed back on farmers problems for new research initiates.