

Achievement (Research recommendations for the farmers) : More than 76 recommendations (copy enclosed).

Crop variety released by the station:

Sr. No.	Name of the crop	Name of the variety	Year of release	Yield, kg/ha	Chief characteristics
1.	Wheat	A-206	1955	1300-1400	Plant height :70 cm,Number of tillers/ plant:4,Length of spike : 6.5-7.0 cm,Seed colour: white-amber10% mottling,Days to maturity : 110
2.		A28	1977	1300-1600	Plant height :61 cm,Number of tillers/ plant : 5-6,Length of spike : 7.0 cm,Seed colour: amber,Days to maturity : 120
3.		GW-1	1981	1500-1700	Plant height : 72 cm,Number of tillers/ plant : 4-5,Length of spike : 7.5 cm,Seed colour: Amber with less mottling and resistance to Rust,Days to maturity : 115
4.	Gram	GG-2	1999	1307	Plant height : 35 cm,Number of tillers/ plant : 4-5,Length of spike : 7.5 cm, Seed colour: Amber with less mottling and resistance to Rust,Days to maturity : 94
5.	Dill seed	GD-2		935	Plant height : 82 cm,Days to maturity : 139 Essential oil % : 4.0

Awards - achieved for the research work done at ARNEJ..

The outstanding work carried out by the scientists of this research station has brought the prestigious '**SARDAR PATEL AGRICULTURAL RESEARCH**' award consequently for **three years** for 1998-99, 1999-2000 and 2000-01 and has uplifted the centre's name and fame.

The Govt. of Gujarat has been pleased to confer the Sardar Patel Agricultural Research Second Award to Dr. G. L. Maliwal and co-workers Dr. A. Das, Shri K. S. Parmar, Shri J. H. Vaghani, Shri C. T. Chand and Dr. M. S. Jakasaniya of Arnej centre, for outstanding contribution towards Agricultural Development Research and Technology in the field of Agronomy & Soil Science for the year 1998-99

The Govt, of Gujarat has been pleased to award the Sardar Patel Agricultural Research Second Award for the year 1999-2000 jointly to Shri D. P. Gohil and co-workers for his outstanding work on chickpea varietal improvement and release of new variety GG-2 in the subject of Research on Plant breeding and Genetics.

The Govt, of Gujarat presented the Sardar Patel Agricultural Research Second Award for the year 2000-2001 jointly to Shri J .B .Raol and co-workers Dr. P. T. Patel, Dr. L. P .Singh, Dr. R. F. Sutar, Shri M. D .Vora and Shri K .V .Vala for developing a bullock driven seed cum fertilizer drill suitable for Bhal area in the subject of Research on Agronomy, Soil Science and Agricultural Engineering.

વિભાગીય વૈજ્ઞાનિકોએ રજૂ કરેલ સંશોધન પેપરનાં ટાઈટલ :

PUBLICATIONS

PUBLICATIONS

Year	Research paper published	Research paper presented	Gujarati article published
1987			3
1988	1		2
1989			3
1990	2		3
1991	3		2
1992	2		2
1993			
1994			5
1995			4
1996	1		5
1997	3	2	7
1998	5		8
1999	3		8
2000	1	3	4
2001	1	2	4
2002	2	10	3
2003	2		3
2004	2		3
2005	1	2	
2006			
2007		5	
2008		1	
Total	27	25	70

વિભાગીય વૈજ્ઞાનિકોના પોપ્યુલર આર્ટીકલ

અ.નં.	વૈજ્ઞાનિકનું નામ	પેપરનું શિર્ષક	અંક અને વર્ષ	પ્રસિદ્ધ થયેલ મેગેઝીનનું નામ
૧	માલીવાલ, જી એલ	ખેત તલાવડી	ઓગષ્ટ, ૧૯૮૭	કૃષિગોવિદ્યા
૨	માલીવાલ, જી એલ	ભાલ પ્રદેશ માટે બિનપિયત ઘઉંનું ઉત્પાદન વધારવાના ચાવીરૂપ મુદ્દાઓ	ઓગષ્ટ, ૧૯૮૭	કૃષિગોવિદ્યા
૩	માલીવાલ, જી એલ	ગંભીર દુષ્કાળમાં ખારા પાણીનો સમજપૂર્વક ઉપયોગ કરી પાક ઉગાડવો	માર્ચ, ૧૯૮૭	કૃષિગોવિદ્યા
૪	ઘડૂક, એલ કે, માલીવાલ, જી એલ	ભાલ પ્રદેશમાં અર્ધશિયાળું તલ તથા સુર્યમુખીની ખેતીની શક્યતા	જુલાઈ, ૧૯૮૮	કૃષિજીવન
૫	ઘડૂક, એલ કે, માલીવાલ, જી એલ	ભાલપ્રદેશ માટે તેલીબીયાના પાકોનું આશાસ્પદ ભાવિ	સપ્ટે. ૧૯૮૮	કૃષિજગત
૬	ઘડૂક, એલ કે, માલીવાલ, જી એલ	ભાલ માટે ભાસચારાની જુવાર	ઓગષ્ટ, ૧૯૮૯	કૃષિજીવન
૭	ઘડૂક, એલ કે, માલીવાલ, જી એ	ભાલમાં સુર્યમુખીની આશાસ્પદ ખેતી	જુલાઈ, ૧૯૯૧	કૃષિજીવન
૮	માલવીયા, ડી ડી માલીવાલ, જી એલ ઠાકર, કે આર	ભાલ વિસ્તારમાં ખેતતલાવડી જીવાદોરી સમાન	જુન, ૧૯૮૯	કૃષિગોવિદ્યા
૯	ઘડૂક, એલ કે, માલીવાલ, જી એલ	ભાલમાં કસુબીની નફાકારક ખેતી	ઓક્ટો, ૧૯૯૦	કૃષિજગત
૧૦	માલીવાલ, જી એલ	ભાપ્રદેશમાં વનીકરણની શક્યતાઓ	ઓગષ્ટ, ૧૯૯૦	કૃષિજીવન
૧૧	પટેલ એમ એમ મુલચંદાની, એલ એચ માલીવાલ, જી એલ	ભલવિસ્તારમાં લીલીઈયળ અને ખર્ચેડીથી થતું નુકશાન અને તેનું નિયંત્રણ	નવેમ્બર, ૧૯૯૦	કૃષિગોવિદ્યા
૧૨	માલીવાલ, જી એલ	ક્ષારીય અને ભાસ્મીક જમીનમાં વધુ ઉત્પાદન માટે લેવાતાં પગલાં	ઓગષ્ટ, ૧૯૯૧	કૃષિગોવિદ્યા
૧૩	માલીવાલ, જી એલ પટેલ જી આર	ક્ષારીય જમીનની જૈવીક સુધારણા એક નવો અભિગમ	ડીસે. ૧૯૯૧	કૃષિગોવિદ્યા
૧૪	માલીવાલ, જી એલ	ભાલવિસ્તારમાં બોરની ખેતી એક નવો અભિગમ	ઓગષ્ટ, ૧૯૯૨	કૃષિગોવિદ્યા
૧૫	માલીવાલ, જી એલ	ભાલમાં તેલીબીયા પાકોની નફાકારક ખેતી	ઓગષ્ટ, ૧૯૯૨	કૃષિગોવિદ્યા
૧૬	અમીન, એ એમ સોનાની વી વી પટેલ પી ટી જાકાસણીયા એમ એસ	સુકા અને ક્ષારીય ભાલ પ્રદેશમાં ઘઉંની ખેતી	ઓક્ટો. ૧૯૯૪	કૃષિગોવિદ્યા
૧૭	અમીન, એ એમ સોનાની વી વી પટેલ પી ટી જાકાસણીયા એમ એસ	ભાલનો શિયાળું કઠોળ પાક - ચણા	ઓક્ટો. ૧૯૯૪	કૃષિગોવિદ્યા
૧૮	ઘોઘારી પી ડી મુલચંદાની, એલ એચ	બોટલ ઉપર રંગ ધ્વારા જંતુનાશક દવાના ઝેરની પરખ કરવી	ઓક્ટો. ૧૯૯૪	કૃષિગોવિદ્યા
૧૯	જાબુકીયા બી એચ	ભાલમાં સુવાની ખેતી	ઓક્ટો. ૧૯૯૪	કૃષિજીવન

	વઢવાણીયા એચ કે સોનાની વી વી પટેલ પી ટી			
૨૦	વઢવાણીયા એચ કે પટેલ એચ બી જાબુકીયા બી એચ પટેલ પી ટી	ભાલ વિસ્તાર માટે આશાસ્પદ પાક કસુંબી	સપ્ટે.૧૯૯૪	કૃષિજીવન
૨૧	જાબુકીયા બી એચ વઢવાણીયા એચ કે પટેલ એચ બી પટેલ પી ટી	ભાલના પાકોની સુધારેલ જાતો	જૂન,૧૯૯૫	કૃષિજીવન
૨૨	જાબુકીયા બી એચ વઢવાણીયા એચ કે પટેલ એચ બી પટેલ પી ટી	ભાલ વિસ્તાર માટે આશાસ્પદ પાક કસુંબી	જૂન,૧૯૯૫	કૃષિ વિજ્ઞાન
૨૩	રાઓલ જે બી સોનાની વી વી પટેલ પી ટી	ભાલ વિસ્તાર માટે ખેતતલાવડીનુ મહત્વ અને ઉપયોગીતા	માર્ચ,૧૯૯૫	કૃષિ વિજ્ઞાન
૨૪	વઢવાણીયા એચ કે પટેલ એચ બી જાબુકીયા બી એચ પટેલ પી ટી	ભાલીયા ઘઉં (દાઉદખાની ઘઉં)ની પરખ કેમ કરશો ?	માર્ચ,૧૯૯૫	કૃષિગોવિદ્યા
૨૫	વઢવાણીયા એચ કે પટેલ એચ બી જાબુકીયા બી એચ પટેલ પી ટી	સુકી ખેતીમાં ચોમાસુ પાક આયોજન	જૂન,૧૯૯૫	કૃષિજીવન
૨૬	રાઓલ જે બી પટેલ પી ટી	ભાલ વિસ્તારમાં ખેતતલાવડીમાંથી થતો પાણીનો વ્યય અને તેને ઘટાડવા માટેના ઉપયો	માર્ચ,૧૯૯૬	કૃષિ વિજ્ઞાન
૨૭	રાઓલ જે બી સોનાની વી વી પટેલ પી ટી	ભાલ વિસ્તારમાં આધુનિક ખેત ઓજારો	સપ્ટે.૧૯૯૬	કૃષિજીવન
૨૮	સોનાની વી વી પટેલ પી ટી રુપાણી કે એ	બિનપિયત કપાસનુ પહોળા પાટલે વાવેતર એક નુતન અભિગમ	જુલાઈ,૧૯૯૬	કૃષિજીવન
૨૯	વઢવાણીયા એચ કે જાબુકીયા બી એચ પટેલ એચ બી પટેલ પી ટી	ભાલ વિસ્તારમાં અર્ધશિયાળુ જુવારની શક્યતાઓ	ઓક્ટો.૧૯૯૬	કૃષિગોવિદ્યા
૩૦	વઢવાણીયા એચ કે જાબુકીયા બી એચ અમીન,એ એમ પટેલ એચ બી પટેલ પી ટી	સુર્યમુખી એક અગત્યનો તેલીબીયાં પાક	ઓક્ટો.૧૯૯૬	નર્મદા િકસાન પરિવાર પત્ર
૩૧	રાઓલ જે બી પટેલ પી ટી	ભાલ વિસ્તાર માટે બળદથી ચાલતો ઓટોમેટીક વાવણીયો	નવે.૧૯૯૭	નૂતન કૃષિ
૩૨	સોનાની વી વી	ભાલ વિસ્તારનો રોકડીયો પાક કપાસ	જુલાઈ,૧૯૯૭	કૃષિજીવન

	પટેલ પી ટી પટેલ જી એ પઢાર ટી કે			
૩૩	સોનાની વી વી વઢવાણીયા એચ કે પટેલ પી ટી પટેલ કે જે	ભાલ વિસ્તારના ખેતી પાકોમાં મર્યાદીત પિયત વ્યવસ્થા	નવે.૧૯૯૭	કૃષિગોવિદ્યા
૩૪	વઢવાણીયા એચ કે જાબુકીયા બી એચ અમીન, એ એમ પટેલ એચ બી પટેલ પી ટી	ભાલના શિયાળુ પાકોની સુધારેલી જાતો	નવે.૧૯૯૭	નર્મદા કિસાન પરિવાર પત્ર
૩૫	વઢવાણીયા એચ કે સોનાની વી વી પટેલ એચ બી પટેલ પી ટી	કસુંબીની ખેતી	જુન, ૧૯૯૭	કૃષિજીવન
૩૬	પટેલ પી ટી સોનાની વી વી દાસ એ જાકાસણીયા એમ એસ પઢાર ટી કે	ક્ષારીય વિસ્તાર માટે સુકી ખેતી અંગે થયેલ સંશોધન અને સીધ્ધીઅ	માર્ચ, ૧૯૯૮	કૃષિજીવન
૩૭	સોનાની વી વી પટેલ પી ટી પઢાર ટી કે પટેલ ડી ડી	ઘઉંની અતિ આધુનિક પિયત, બિનપિયત ખેતી એટલે ઓછા ખર્ચે મબલખ પાક મેળવવો	નવે.૧૯૯૭	નૂતન કૃષિ
૩૮	સોનાની વી વી પઢાર ટી કે પટેલ જી જી પટેલ પી ટી	સુકી ખેતીમાં આંતર પાક પદ્ધતિ	જુન, ૧૯૯૮	કૃષિ જીવન
૩૯	વઢવાણીયા એચ કે અમીન, એ એમ પટેલ એચ બી જાબુકીયા બી એચ પટેલ પી ટી	ભાલ વિસ્તારના રવિપાકોમાં સંશોધન આધારીત ભલામણો	ઓક્ટો. ૧૯૯૮	કૃષિ જીવન
૪૦	વઢવાણીયા એચ કે સોનાની વી વી જાબુકીયા બી એચ પટેલ પી ટી	સુર્યમુખીની ખેતી પદ્ધતિ	ફેબ્રુ.-એપ્રિલ- ૧૯૯૮	નૂતન કૃષિ
૪૧	વઢવાણીયા એચ કે સોનાની વી વી પટેલ પી ટી	સંશોધનના સથવારે	જુન, ૧૯૯૮	કૃષિજીવન
૪૨	વઢવાણીયા એચ કે જાબુકીયા બી એચ પટેલ પી ટી	સંગ્રહીત ભેજ પર તલ-પુર્વા-૧ ની ખેતી	સપ્ટે. ૧૯૯૮	નર્મદા કિસાન પરીવાર પત્ર
૪૩	ઘોઘારી પી ડી મુલચંદાની, એલ એચ પટેલ પી ટી	પંપમાં વપરાતી વિવિધ પ્રકારની નોઝલો	મે, ૧૯૯૯	કૃષિગોવિદ્યા

૪૪	ગોહીલ ડી પી પટેલ પી ટી	ચણાની નવી જાત -ગુ.ચણા.૨	ઓક્ટો.૧૯૯૯	કૃષિજીવન
૪૫	ગોહીલ ડી પી પટેલ પી ટી	ચણામાં રાઈઝોબીયમ કલ્ચરનો ઉપયોગ	ઓક્ટો.૧૯૯૯	કૃષિજીવન
૪૬	ગોહીલ ડી પી સોનાની વી વી પટેલ પી ટી	સંશોધનના સથવારે બિનપિયત ઘઉંની ખેતી	ઓક્ટો.૧૯૯૯	કૃષિજીવન
૪૭	પટેલ પી ટી સોનાની વી વી પટેલ જી જી પટેલ જી એ	ભાલ વિસ્તારના શિયાળુ પાકોની ખેતી પધ્ધતિ	ઓક્ટો.૧૯૯૯	કૃષિજીવન
૪૮	સોનાની વી વી પટેલ પી ટી વઢવાણીયા એચ કે પઢાર ટી.કે.	જુદા જુદા પાકોની પાણીની જરૂરીયાત	માર્ચ, ૧૯૯૯	કૃષિ જીવન
૪૯	સોનાની વી વી પટેલ પી ટી વઢવાણીયા એચ કે પટેલ જી.જી.	શિયાળુ પાકોની પિયત વ્યવસ્થા	સપ્ટે.૧૯૯૯	કૃષિગોવિદ્યા
૫૦	વાઘાણી જે એચ વાળા કે વી દાસ એ પટેલ પી ટી	ભાલની ક્ષારીય જમીનમાં કરમદા ઉગાડવાની શક્યતાઓ	એપ્રિલ, ૧૯૯૯	કૃષિગોવિદ્યા
૫૧	ઘોઘારી પી ડી મુલચંદાની, એલ એચ પટેલ પી ટી	ભાલ વિસ્તારમાં ફેરોમેન ટ્રેપ ધ્વારા કીટક નિયંત્રણનો અભ્યાસ	ડીસે.૨૦૦૦	નર્મદા િ કસાન પરિવાર પત્ર
૫૨	પટેલ પી ટી	બિનપિયત ઘઉંની આદર્શ ખેતી પધ્ધતિ	સપ્ટે.૨૦૦૦	કૃષિ જીવન
૫૩	સોનાની વી વી પટેલ પી ટી ગોહીલ ડી પી દાસ એ	સંગ્રહીત ભેજમાં રાઈની ખેતી	ઓક્ટો.૨૦૦૦	કૃષિગોવિદ્યા
૫૪	વાઘાણી જે એચ દાસ એ વઢવાણીયા એચ કે પટેલ પી ટી	ભાલ પ્રદેશની મધ્યમ કાળી જમીનમાં દાડમ ફળાડની શક્યતા	જુન, ૨૦૦૦	નર્મદા િ કસાન પરિવાર પત્ર
૫૫	વાળા કે વી સોનાની વી વી પટેલ પી ટી	વરસાદના વહી જતાં પાણીનું અર્થકરણ અને પિયત માટે કાર્યક્ષમ ઉપયોગ	મે.૨૦૦૦	નર્મદા િ કસાન પરિવાર પત્ર
૫૬	વાળા કે વી સોનાની વી વી પટેલ પી ટી	ઓટોમેટીક વાવણીયો - એક બહુવિધ ઉપયોગી ઓજાર	જુન.૨૦૦૦	નર્મદા િ કસાન પરિવાર પત્ર
૫૭	વોરા એમ.ડી પટેલ પી ટી	કૃષિયંત્રો / ઓજારોનો ખેતીમાં ઉપયોગ	જાન્યુ.૨૦૦૦	કૃષિગોવિદ્યા
૫૮	વોરા એમ.ડી પટેલ પી ટી	કૃષિયંત્રો / ઓજારોનો આધુનિક ખેતીમાં ફાળો	ફેબ્રુ.૨૦૦૦	કૃષિગોવિદ્યા
૫૯	ગોહીલ ડી પી	ભાલ વિસ્તાર માટે અનુકુળ દેશી	જુલાઈ, ૨૦૦૧	નર્મદા િ કસાન

	સોનાની વી વી પટેલ પી ટી	કપાસની નવી જાત - ગુ.કપાસ.૨૧		પરિવાર પત્ર
૬૦	સોનાની વી વી પટેલ પી ટી પટેલ જી જી ગોહીલ ડી પી	બિનપિયત કપાસમાં આંતરપાક પધ્ધતિ	ઓગષ્ટ,૨૦૦૧	નર્મદા િ કસાન પરિવાર પત્ર
૬૧	સોનાની વી વી પટેલ પી ટી ગોહીલ ડી પી દાસ એ	ભાલ પ્રદેશમાં રાઈની ખેતી પધ્ધતિ	નવે.૨૦૦૧	નર્મદા િ કસાન પરિવાર પત્ર
૬૨	પટેલ પી ટી	ક્ષારીય જમીનમાં ખેતી	૨૦૦૨	
૬૩	સોનાની વી વી પટેલ પી ટી ગોહીલ ડી પી	ટ્રેક્ટર અને થ્રેસર સાથે કામ કરતી વખતે શું કાળજી રાખશો ?	સપ્ટે.૨૦૦૨	કૃષિ જીવન
૬૪	સોનાની વી વી પટેલ પી ટી ગોહીલ ડી પી	શિયાળુ પાકોમાં રાસાયણીક ખાતર વ્યવસ્થા	ડીસે.૨૦૦૨	નર્મદા િ કસાન પરિવાર પત્ર
૬૫	જાકાસાણીયા એમ એસ માથુકીયા એચ વી દાસ એ પટેલ પી ટી	ક્ષારીય અને ભાસ્મીક જમીનની લાક્ષણિકતાઓ અને સુધારણા	જાન્યુ.૨૦૦૩	કૃષિ જીવન
૬૬	પટેલ પી ટી સોનાની વી વી વાઘેલા એન.વી.	ભાલ પ્રદેશમાં જીરૂના પાક માટે અનુકૂળ પિયત પધ્ધતિ	જૂન,૨૦૦૩	ગુજરાત કીસાન
૬૭	સોનાની વી વી પટેલ જી જી પટેલ જી એ પટેલ પી ટી	જવાસીયા ભાલ વિસ્તારનો એક હઠીલુ નિંદામણ	જાન્યુ.૨૦૦૩	ગુજરાત કીસાન
૬૮	પટેલ એ જે પટેલ કે એચ	ચણાની લીલી ઈયળની સંકલિત નિયંત્રણ વ્યવસ્થા	સપ્ટે.૨૦૦૪	કૃષિ ગોવિંદા
૬૯	પટેલ એ જે	ચણાની લીલી ઈયળનું સંકલિત જીવાત નિયંત્રણ	ફેબ્રુ.૨૦૦૪	કૃષિ જીવન
૭૦	પટેલ એ જે	ચણાની લીલી ઈયળ સસ્તુ સલામત અને અસરકારક નિયંત્રણ	ડીસે.૨૦૦૩	નર્મદા િ કસાન પરિવાર પત્ર

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Recommendation for farmers

Year	Agro.	Soil Science	Horti. & Agro-Forestry	Ento.	Plant Patho	Plant Physio	Agril. Engg.	Total
1984	1							1
1985								0
1986		1			1*			2
1987								0
1988	1							1
1989								0
1990	2							2
1991	3							3
1992	1		2		2			5
1993	2			1		1+2**		6
1994	1+2*			1				4
1995	1	2					1	4
1996	5	4	1					10
1997	2			1	1			4
1998	1	1+1**					1	4
1999	3					2		5
2000	2			2				4
2001	7							7
2002		2						2
2003		2	1					3
2004	1							1
2005	1							1
2006	2						1	3
2007	1						2	3
2008	1						1	2
Total	40	13	4	5	4	5	6	77

RECOMMENDATIONS FOR THE FARMERS

1984

➤ **Limited irrigation in Wheat (1984)**

It is recommended to recycle the harvested runoff water for protective irrigation of 50 mm in wheat GW-1 at maximum tillering stage for getting higher yield. Irrigating the crop at CRI stage is equally beneficial and may be preferred in order to avoid loss from farm pond.

1986

➤ **Use of Gypsum in marginal sodic soil (1986)**

Gypsum @ 1.0 t/ha should be applied once in four years to marginal sodic soil (ESP around 10) for successful production of wheat in Bhal region.

➤ **Use of Azolla in Dry Wheat as N Source (1986)**

Application of 25 Kg N/ha in the form of dry azolla i.e. 625 Kg/ha gave additional yield of 316 kg/ha over control in dry wheat GW-1 at Dhandhuka.

1988

➤ **Seed rate and nitrogen requirement of Wheat GW-1 (1988)**

For getting the higher yield of Wheat GW-1 and maximum return per rupee invested for inputs like seeds and nitrogenous fertilizer, it should be sown by using 60 kg seed per hectare and fertilized with 20 kg N/ha as a basal dose.

1990

➤ **Sowing time for rainfed Wheat (1990)**

It is recommended that the farmers of Bhal and Coastal Agro climatic region should sow wheat (dry) latest by middle of November. Further delay decreases the yield.

➤ **Response of sorghum varieties to nitrogen and phosphorus (1990)**

The farmers of Bhal and Coastal Agro climatic Zone are advised to apply 15 kg P2O₅/ha to fodder sorghum variety “Trapaj” as basal application to get net ICBR 1:7.1 and 1:1.8 respectively.

1991

➤ **Seed rate and spacing requirement for Gram in Bhal region (1991)**

The farmers of Bhal region are advised to use 40 kg seeds/ha with inter row spacing of 30 cm for gram variety ‘Chaffa’.

➤ **Spacing requirement of Pigeonpea (1991)**

It is recommended that Pigeonpea can be grown at 60 cm or 75 cm inter-row spacing in the Bhal and Coastal Agro climatic Zone.

➤ **Intercropping in rainfed Cotton (1991)**

It is recommended that the farmers of Bhal region are advised to adopt intercropping of green gram or black gram in paired row system of planting cotton G.Cot.13 variety for getting higher additional realization.

1992

➤ **Fertilizer requirement of Castor (1992)**

The farmers of Bhal and Coastal Agro climatic Zone are advised to apply 25 kg N/ha to castor crop to obtain seed yield of 620 kg/ha (NICBR 1:1.05).

➤ **Bio-desalinization of soil through *Prosopis juliflora* (1992)**

The farmers are advised to grow *Prosopis juliflora* in salt affected soil for 6 to 7 years so as to reduce the total salt concentration (EC 2.5) from 0.95 to 0.38 ds/m and ESP from 24.5 to 6.7 with increase in the infiltration rate from 0.25 to 0.53.

➤ **Recommendation on Arid fruit (1992)**

The farmers of Bhal and Coastal Zone are advised to adopt the ber variety 'Gola' under rainfed conditions to obtain a net return of Rs.16575/ha (ICBR 1:5.25).

➤ The crop should be fertilized with 500 g castor cake and 50g DAP per pit before planting and 50g DAP and 75g Urea every subsequent years.

➤ **Use of Rhizobium culture in gram (1992)**

For getting maximum chickpea (var.Chaffa) yield, farmers of Bhal and Coastal Zone are advised to use *Rhizobium* culture GRS-4 (1×10^8 cells/g) @ 200g/8 kg seeds (ICBR 1:17.61).

➤ **Optimum sowing time for gram (1992)**

Farmers of Bhal and Coastal zone are advised to adopt chickpea sowing during second fortnight of October (21-25 October) for minimizing the wilt disease and maximizing the crop yield (Net income Rs.3757/ha).

1993

➤ **Limited irrigation in Mustard (1993)**

The farmers of Bhal and Coastal Agro climatic Zone are advised to give one irrigation of 50 mm from runoff harvested water in farm pond to mustard at 30 DAS for securing higher yield (969 kg/ha) and net ICBR of 1:4.96). In case, monsoon is prolonged up to October, there is no need to irrigate the mustard crop.

➤ **Irrigation x fertilizer study in gram (1993)**

For getting the economical yield of gram cv. 'Chaffa' under conserved moisture condition, an application of 20 kg N/ha is recommended to the farmers of Bhal Zone. Further, the farmers of Bhal and Coastal Zone be advised to give one irrigation of 50 mm from runoff harvested water to gram at maximum branching stage for securing higher yield and net realization per unit area if the facility for one irrigation is available. Under this condition he may go for higher dose of nitrogen i.e. 40 kg N/ha for higher net return. Phosphorus application did not give response with or without irrigation.

➤ **Safe storage of wheat grain (1993)**

Wheat seed/grain (GW-1 variety) after having been dried under sunlight, coated with castor oil @ 500 ml/100 kg seed or mixed with dried neem leaves @ 2 kg/100 kg seeds can be stored safely in galvanized bins against lesser grain borer under Bhal conditions.

➤ **Receding soil moisture in Cotton var. G.Cot.13 (1993)**

In the Bhal and Coastal Agro climatic Zone cotton should be sown when the soil moisture is around 24% for securing adequate germination. In case the sowing is delayed, the farmers are advised to sow even upto 14% moisture level but with increasing the seed rate by 50%. This level of moisture under field conditions will be obtained 25-30 days after the inception of monsoon.

1994

➤ **Interculturing in Wheat (1994)**

The farmers of Bhal and Coastal Zone growing Wheat (GW-1) are advised to follow interculturing operations maximum six times commencing from just before initiation of cracking (45 DAS) at an interval of 8-10 days. This helps to increase the yield by checking the evaporation losses through the soil mulch development.

➤ **Spacing and NP requirement of Safflower (1994)**

The farmers of Bhal and Coastal Zone (AES 1A & 1B) are advised to grow

Safflower at 45 cm or 60 cm row spacing. Application of N and P is not beneficial.

➤ **Fertilizer management in cotton-sorghum (fodder) crop rotation (1994)**

The farmers of Bhal and Coastal Zone, practicing cotton-sorghum crop rotation are advised to apply 12.5 kg N/ha only to cotton crop. There is no need to apply chemical fertilizer to sorghum crop.

➤ **Management of safflower aphid (1994)**

The safflower aphid (*Euroleucon compositae*) in Bhal region can effectively and economically be controlled by spraying Dimethoate 0.03% (ICBR 1:12.59) or Monocrotophos 0.04% (ICBR 1:7.33) or Methyl-o-demeton 0.025% (ICBR 1:7.46) or Phosphamidon 0.03% (ICBR 1:5.54).

1995

➤ **Fertilizer requirement of Paddy (1995)**

For transplanted paddy (SLR 51214) an application of 10 t FYM + 150 kg N/ha is recommended to the farmers of Bhal and Coastal Agro-climatic Zone. However, in case of short supply of fertilizer or due to poor economical condition of farmers, one may go for 10 t FYM + 100 kg N/ha.

➤ **Saline water irrigation in Wheat (1995)**

The farmers of Bhal Zone, where the groundwater is saline may irrigate the wheat crop in drought year with saline water (3 irrigations) along with the soil amendment of press mud @ 10 t/ha or Gypsum @ 6 t/ha.

➤ **Pond water irrigation in Wheat (1995)**

Farmers of Bhal and Coastal Zone under situation of good quality of irrigation water availability are advised to irrigate wheat (GW-1) thrice (50mm each at tillering, flowering and grain filling stages) for securing 177% more yield than rainfed.

➤ **Use of LDPE sheet as lining material in dugout pond (1995)**

In Bhal region, for minimizing the loss of stored water from the dugout pond, the depth of pond should be of 1.5 m. LDPE sheet (100 micron) can be used as a lining material in dugout pond to reduce further seepage loss of stored water.

1996

➤ **Spacing requirement for Cotton (1996)**

The farmers growing rainfed cotton (G.Cot.13) in Bhal and Coastal Agro-climatic Zone are advised to adopt an inter row spacing ranging from 120cm to 200cm depending upon the availability of bullock or tractor drawn implements.

➤ **Intercropping in Wheat (1996)**

The farmers of Bhal and Coastal Agro-climatic Zone are advised to adopt intercropping system involving wheat + Safflower in 3:1 row ratio at a spacing of 30 cm (CBR 1:3.24).

➤ **Sowing time for mustard (1996)**

The farmers of Bhal and Coastal Agro-climatic Zone are advised to sow mustard between 10th and 20th October. In case, the maximum temperature around 10th October is found more than 35 °C, sowing should be performed around 20th October.

➤ **Spacing requirement of safflower varieties (1996)**

The farmers of Bhal and Coastal Agro climatic Zone are advised to grow safflower variety A-1 or Bhima at a geometry of 75cm x 15cm.

➤ **Fertilizer requirement of Safflower varieties (1996)**

The farmers of Bhal and Coastal Agro-climatic Zone are advised to fertilize safflower (variety A-1 or Bhima) with 25 kg N/ha. Safflower did not respond to applied phosphorus.

➤ **Foliar application of N in Wheat (1996)**

Foliar application of N was not found beneficial to wheat (GW-1) under conditions of Bhal and Coastal Zone.

➤ **Saline water irrigation in grasses (1996)**

Farmers of Bhal and Coastal Zone having insufficiency of fodder grass for their cattle, particularly during drought period, can grow “Gutton panic” or Dichanthium grass through saline water irrigation (up to 8 ds/m). After every three years they are advised to change the site.

➤ **Water Management Through Land configuration (1996)**

Farmers of Bhal and Coastal Zone are advised to adopt raised (15cm above surface) and sunken (15cm below surface) bed system (6m width) of cultivation

for getting higher benefit in terms of substantial yield of kharif and rabi crops. They are advised to grow cotton on raised beds during kharif and wheat or gram on sunken beds during rabi for securing higher income (ICBR 1:2.39).

➤ **Method of fertilizer application in Gram (1996)**

Gram (Chaffa) seeds @ 40 kg/ha mixed with fertilizer (10 Kg N + 200 Kg P₂O₅) can be sown under conserved soil moisture condition.

➤ **Reclamation of saline-sodic soils (1996)**

For improving saline-sodic /waste soil to cultivable land, farmers of Bhal and Coastal Zone are advised to grow *Prosopis juliflora* or *Acacia tortilis* or *Azadirachta indica* forest species for a period of 6-7 years. They are also benefited with the fuel wood after 6-7 years besides improving the land. In case of non-availability of the above species, farmers may go in for *Salvadora spp.* As that also gives fodder/fuel and seeds containing high value oil.

- Forest tree species like *Albizia lebbek*, *Moringa oleifera*, *Sesbania egyptica*, *Tecomella undulata*, *Atriplex halimus*, *Casurina spp.* and Eucalyptus hybrid have shown very low to no adaptability.

1997

➤ **Time of sowing for Cotton (1997)**

The farmers of Bhal and Coastal Zone should sow the cotton crop at the onset of monsoon but not later than first week of August.

➤ **Irrigation x Fertilizer study in mustard (1997)**

The farmers of Bhal and Coastal Agro-climatic Zone are advised to fertilize mustard with 60 kg N/ha for obtaining economic yield under conserved moisture conditions. In case of harvested rain water availability crop should be irrigated at 30 DAS with 50 mm of water and fertilize with 60 kg N + 20 kg P₂O₅/ha.

➤ **Management of surface grass hopper (1997)**

Farmers are advised to undertake preventive measures by dusting Methyl parathion 2% dust @ 25 kg/ha on bunds surrounding wheat crop so that the pests which survive on jowar and then migrate to wheat seedlings may come in contact with insecticides and get killed before destroying wheat seedling. They are also advised to cut jowar crop in time so that the adult may die due to starvation in absence of food during the period from harvest of sorghum to sowing of wheat.

➤ **Economic control of powdery mildew in chickpea (1997)**

For effective and economic control of powdery mildew in chickpea, two sprays of Dinocap @ 0.025% or Wettable Sulphur @ 0.2% or Tridemorph @ 0.04% at an interval of 15 days starting from appearance of disease are recommended to the farmers of Bhal and Coastal Agro climatic Zone.

1998

➤ **Spacing and seed rate requirement of rain fed wheat (1998)**

Farmers of Bhal and Coastal Zones (AES 1a and b) are advised to grow wheat (GW-1) at 30 cm inter row spacing with a seed rate of 50 kg/ha (Dhandhuka).

➤ **Fertilizer requirement of fodder sorghum GFSH-1 (1998)**

Farmers of Bhal and Coastal Agro-climatic Zone (AES II) growing fodder sorghum (var.GFSH-1) under rainfed situation are advised to apply 40 kg N and 10 kg P₂O₅ /ha for doubling the yield in soils of low N and P status.

➤ **Bullock drawn automatic seed-cum-fertilizer drill (1998)**

Bullock drawn automatic seed cum fertilizer drill is designed, tested and recommended for Bhal and Coastal Zone for uniform placement of seeds of wheat and gram with fertilizer.

1999

➤ **Crop geometry for mustard (1999)**

The farmers of Bhal and Coastal Zone are advised to grow mustard at a crop geometry of 75 cm x 15 cm or 90 cm x 15 cm.

➤ **Crop geometry for dillseed (1999)**

The farmers of Bhal and Coastal Zone are advised to grow dillseed at a crop geometry of 75 cm x 30 cm.

➤ **Spacing and N management study in gutton panic (1999)**

The Farmers of Bhal and Coastal Zone who are interested to grow gutton panic are advised to plant the grass at the geometry of 45 cm x 30 cm or 30 cm x 30 cm and fertilize with 75 kg N/ha/year.

➤ **Saline water usage in Safflower (1999)**

It is recommended to the farmers of Bhal region that one irrigation of 50 mm depth at branching from harvested rain water to safflower increases the seed yield. Saline water use though increases the yield tends to deteriorate the soil health.

➤ **Saline water usage in Cotton (1999)**

Farmers of Bhal and Coastal Zone (AES 1B) growing Cotton G.Cot.13 can apply two irrigations of saline water (up to 8 ds/m at 30 and 45 days after withdrawal of monsoon for sustaining seed cotton yield during drought years. Where source of harvested rainwater is available, out of two irrigations, first one may be applied from harvested rain water.

2000

➤ **Use of Cycocel in Safflower (2000)**

Farmers of Bhal and Coastal Agro-climatic Zone, interested to grow safflower are advised to spray Cycocel @ 500 ppm at flower initiation or 50% flowering stage.

➤ **Effect of sources and levels of sulphur on seed and oil yield of Safflower (2000).**

➤ The farmers of Bhal and Coastal Zone interested to grow Safflower are advised to apply sulphur @ 30 kg/ha to obtain higher yield and return. The sulphur may be applied through ammonium sulphate or gypsum or single super phosphate.

➤ **Management of Heliothis in Pigeonpea (2000)**

For effective and economic control of Pigeonpea pod borer (*H.armigera*), farmers of Bhal and Coastal Zone are advised to apply methyl parathion 2% dust either two times i.e. first at 50% flowering and second at 50% pod formation (ICBR 1:9.33) or three times i.e. first at the initiation of flowering, second at 50% flowering and third at pod formation (ICBR 1:6.83).

➤ **Economic control of Gram pod borer (2000)**

The farmers of Bhal and Coastal Zone are advised to apply methyl parathion 2% dust @ 25 kg/ha (ICBR 1:2.78) OR Neem seed kernel suspension @ 5% (ICBR 1:6.61) at the appearance of the pest on gram crop for effective and economic control of pod borer, *Helicoverpa armigera* Hubner.

2001

➤ **Optimization of safflower production under resource constraints (2001)**

The farmers of Bhal region growing safflower are advised to follow the recommended package of practices in order to get maximum return from the crop. Of the different inputs, plant protection is the most important and contributes

maximum followed by fertilizers, population adjustment (thinning) and weed control in descending order.

➤ **Phosphorus management in safflower based cropping system (2001)**

The farmers of Bhal and Coastal Agro climatic Zone following safflower-fodder sorghum rotation are advised to inoculate the seeds of both the crops with PSB (*Pseudomonas striata*) in order to save half of the dose of phosphorus.

➤ **Studies on inter cropping in cotton G.Cot.13 (2001)**

The farmers of Bhal and Coastal Agro-climatic Zone cultivating cotton in wider spacing are advocated to take soybean as an intercrop for raising their monetary benefit.

➤ **Response of safflower to bio-fertilizer (2001)**

The farmers of Bhal and Coastal Agro-climatic Zone interested to grow safflower are advised to inoculate the seeds with Azospirillum + Azotobactor in order to save half of nitrogenous fertilizer (12.5 kg N/ha.

➤ **Effect of bio-fertilizer, gypsum and nitrogen on growth and yield of mustard (2001)**

The farmers of Bhal and Coastal Agro-climatic Zone growing mustard under conserved moisture condition are advised to apply 1.0 t gypsum/ha for getting higher yield and net return.

➤ **Relative performance of different grasses and their effect on soil reclamation (2001)**

The farmers of Bhal and Coastal Agro-climatic Zone are advised to grow either Dichanthium or Gutton panic for forage on their marginal lands.

➤ **Contingent planning of *kharif* crops under vagaries of monsoon (2001)**

Under normal monsoon (June-July), the farmers of Bhal and Coastal Agro-climatic Region should prefer cotton, whereas under delayed monsoon (after July) fodder sorghum gives better returns.

2002

➤ **Use of FYM in rainfed wheat (2002)**

Farmers of Bhal and Coastal Zone growing wheat GW-1 under conserved moisture, are advised to apply FYM @ 5 t/ha every year in addition to

recommended dose of nitrogen to get higher yield of wheat and to maintain soil organic matter status.

➤ **Fertilizer and irrigation management in rainfed cotton (2002)**

Farmers of Bhal and Coastal Zone growing cotton, are advised to grow cotton (G.Cot.13) with Composted Farm Waste @ 10 t/ha (applied in furrow) and nitrogen @ 40 kg/ha as basal under two irrigation for getting about 65 per cent higher seed cotton yield over rainfed. They are advised to irrigate the crop at 20 days and 42-43 days after cessation of monsoon (i.e. 75% ASMD).

2003

➤ **Performance of rabi crops under different irrigation levels (2003)**

Farmers of Bhal and Coastal Zone growing *rabi* crops under conserved moisture or under supplementary irrigation are advised to put their first preference to wheat crop, followed by gram and dill seed for getting higher crop yield and higher income. In case of availability of good quality water they are advised to irrigate their crop up to twice (50 mm each) for getting higher yield and income without affecting the soil health.

➤ **Use of potash in rainfed cotton(2003)**

Farmers of *Bhal* and Coastal Zone growing rainfed *herbacium* cotton are advised to apply potassium @ 20 kg K₂O ha⁻¹ at 6 cm soil depth adjacent to cotton row after withdrawal of monsoon for getting higher yield of seed cotton and higher net income.

➤ **Mulching in Ber var. 'Gola' (2003)**

Farmers of Bhal and Coastal Zone growing ber (var. Gola) in poor land under rainfed situation, are advised to adopt surface mulching techniques just after cessation of monsoon with wheat husk (Dantha) spreading around plant up to 2 m with thickness of 5 cm for securing higher yield and higher additional income.

2004

➤ **Effect of levels of nitrogen and phosphorus on 'Solapuri' sorghum under conserved moisture (2004).**

The farmers of Bhal and Coastal Agro-climatic Zone who are growing fodder

sorghum var ' Solapuri' under conserved moisture condition during rabi season, are advise to apply 30 kg N + 15 kg P₂O₅/ha for getting higher yield and economics.

2005

➤ **Studies on chemical control of camel thorn (*Alhagi camelorum*) (2005)**

Farmers of Bhal zone are advised to spray Glyphosate @ 0.4% + 1.5% Ammonium Sulphate for the effective control of camel thorn. As this herbicide is non selective in nature, it should be applied after harvest of the wheat crop.

2006

➤ **Yield and quality of forage sorghum as influenced by intercropping of cowpea and nitrogen levels under rainfed condition.**

Farmers of Bhal and Coastal Zone- VIII (AES II) growing sorghum alone are advised to sow the *kharif* sorghum (SSG 59 3) with cowpea (GFC 3) intercropped in 2:1 row ratio and fertilized with 40 kg N ha⁻¹ and 15 kg P₂O₅ ha⁻¹ to secure higher forage yield with good quality and higher returns under rainfed condition

➤ **Relative performance of different cotton varieties/hybrids under rainfed as well as limited irrigation (2006).**

Farmers of the Bhal and Coastal Zone are advised to give two irrigation, each of 60 mm at 20 and 40 days after withdrawal of monsoon, to cotton varieties for securing higher seed cotton yield.

➤ **Method of sowing(2006)**

The farmers of the Bhal area are advised to use the ridge former attachment for drilling the cotton seeds on the ridges in order to save the seedlings from the stagnation of rainwater in the field for getting requisite plant population and higher cotton yield.

2007

➤ **Effect of graded levels of nitrogen and phosphorus on yield of dillseed under limited irrigation conditions (2007).**

Farmers of Bhal and Coastal Zone are advised to sow the dillseed giving one irrigation of 50 mm after 30 DAS fertilized with 20 kg N ha⁻¹ and 20 kg P₂O₅ ha⁻¹ as basal application and 20 kg N ha⁻¹ as top dressing after irrigation to secure higher yield and better returns. While, under conserved moisture condition, farmers should apply only 40 kg N ha⁻¹ as basal application at the time of sowing.

➤ **Deep tillage for moisture conservation (2007)**

The farmers of the Bhal area are advised to perform deep tillage up to 30 cm with mould board plough at conducive field condition for tillage after considerable rainfall in the month of June in order to conserve more soil moisture in black soil in Bhal region and subsequently higher grain yield of wheat as compared to that under conventional tillage.

➤ **Well recharging in Bhal region(2007)**

The farmers of the Bhal area are advised to use the tube well recharging system adopting 10.5 m deep bore well having 10 cm diameter with sand stone filter made of five layer, each of 30 cm thickness made of various sized stones, aggregates and coarse sand for filtering the run off water available during rainy season from five hectares of land to recharge and improve the quality of water. The farmers can obtain about 45 to 50 per cent additional yield and income by utilizing recharged water

2008

➤ **Evaluation of different genotypes of sorghum under different planting time (*Rabi*).**

Farmers of Bhal and Coastal Zone are advised to sow sorghum variety viz. SSG 59 3 on 15th October to obtain higher green forage and dry fodder yields and better returns under conserved moisture condition in *Rabi* season. In case of delayed sowing (15th November) condition, variety Solapuri should be preferred.

➤ **Evaluation of Ground Water Recharging Systems to Develop Suitable System for Bhal Region**

Among recharging systems, recharging through dug well with filter is

recommended for increasing the quantum of underground water reservoir at a higher rate in large scale for benefit of the farmers of Bhal area. Construction of dug well with filter in any natural depression or a constructional pond is suitable in order to raise the underground water table at much more higher rate of recharge.

➤ **PLANT BREEDING**

Research efforts put in by the Agricultural Research Station and Plant Breeding Section of NARP resulted in the crop improvement and release/notified/identified varieties of rainfed wheat **A-206, A-624, A-28 and GW-1**, gram variety **GG-2**, safflower variety *Bhima* and dillseed variety **GD-2** for *Bhal* and Coastal Agro-climatic Zone. This centre has also contributed in development of cotton varieties **G.cot.21** as testing centre. The comparative characteristics of all these varieties of different crops are given here.

➤ **PLANT PHYSIOLOGY**

➤ **Use of anti-transpirant in Cotton**

Spraying of Kaolin to cotton var.'G.Cot.13' at 50% flowering and boll formation stages did not show significant effect on seed cotton yield in Agro-ecological situation I under Bhal and Coastal Zone.

➤ **Use of growth regulators in Chickpea**

Under Bhal and Coastal Agro-climatic Zone, spraying growth regulators GA3 (25-75 ppm) Kinetin (50-200 ppm), CCC (50-200 ppm) and NAA (10-40 ppm) on chickpea var. 'Chaffa' at 50% flowering and pod formation stages was found not beneficial to increase the yield significantly.

➤ **SOIL SCIENCE**

➤ **Use of plastic mulch in Cotton G.Cot.13**

In Bhal and Coastal Agro-climatic Zone (AES 1b) although the use of black plastic (50 micron) increases the yield by 26 per cent, it is not economically viable with the present co-st of plastic.

➤ **ACHIEVEMENTS (RESEARCH RECOMMENDATION FOR THE FARMERS)**

➤ **RAINFED WHEAT**

Release/ identification of variety of rainfed wheat (T. durum)

- A-206 was identified in 1955.
- A-28 was released in 1977.
- GW-1 was released in 1981.

Use of Gypsum in marginal sodic soil (1986)

- Gypsum @ 1.0 t/ha should be applied once in four years to marginal sodic soil (ESP around 10) for successful production of wheat in Bhal region.

Sowing time for rainfed Wheat (1990)

- It is recommended that the farmers of Bhal and Coastal Agroclimatic region should sow wheat (dry) latest by middle of November. Further delay decreases the yield.

Seed rate and nitrogen requirement of Wheat GW-1 (1988)

- For getting the higher yield of Wheat GW-1 and maximum return per rupee invested for inputs like seeds and nitrogenous fertilizer, it should be sown by using 60 kg seed per hectare and fertilized with 20 kg N/ha as a basal dose.

Spacing and seed rate requirement of rain fed wheat (Dhandhuka) (1998)

- Farmers of Bhal and Coastal Zones (AES 1a and b) are advised to grow wheat (GW-1) at 30 cm inter row spacing with a seed rate of 50 kg/ha (Dhandhuka).

Use of Azolla in Dry Wheat as N Source (1986)

- Application of 25 Kg N/ha in the form of dry azolla i.e. 625 Kg/ha gave additional yield of 316 kg/ha over control in dry wheat GW-1 at Dhandhuka.

FYM and N requirement (2002)

- Farmers of Bhal and Coastal Zone growing wheat GW-1 under conserved moisture, are advised to apply FYM @ 5 t/ha every year in addition to recommended dose of nitrogen to get higher yield of wheat and to maintain soil organic matter status.

Foliar application of N in Wheat (1996)

- Foliar application of N was not found beneficial to wheat (GW-1) under conditions of Bhal and Coastal Zone

Interculturing in Wheat (1994)

- The farmers of Bhal and Coastal Zone growing Wheat (GW-1) are advised to follow interculturing operations maximum six times commencing from just before initiation of cracking (45 DAS) at an interval of 8-10 days. This helps to increase the yield by checking the evaporation losses through the soil mulch development.

Intercropping in Wheat (1996)

- The farmers of Bhal and Coastal Agro-climatic Zone are advised to adopt intercropping system involving wheat + Safflower in 3:1 row ratio at a spacing of 30 cm (CBR 1:3.24).

Limited irrigation in Wheat (1984)

- It is recommended to recycle the harvested runoff water for protective irrigation of 50 mm in wheat GW-1 at maximum tillering stage for getting higher yield. Irrigating the crop at CRI stage is equally beneficial and may be preferred in order to avoid loss from farm pond.

Saline water irrigation in Wheat (1995)

- The farmers of Bhal Zone, where the groundwater is saline may irrigate the wheat crop in drought year with saline water (3 irrigations) alongwith the soil amendment of pressmud @ 10 t/ha or Gypsum @ 6 t/ha.

Pond water irrigation in Wheat (1995)

- Farmers of Bhal and Coastal Zone under situation of good quality of irrigation water availability are advised to irrigate wheat (GW-1) thrice (50mm each at tillering, flowering and grain filling stages) for securing 177% more yield than rainfed.

Management of surface grass hopper (1997)

- Farmers are advised to undertake preventive measures by dusting Methyl paration 2% dust @ 25 kg/ha on bunds surrounding wheat crop so that the pests which survive on jowar and then migrate to wheat seedlings may come in contact with insecticides and get killed before destroying wheat seedling. They

are also advised to cut jowar crop intime so that the adult maydie due to starvation in absence of food during the period from harvest of sorghum to sowing of wheat.

Safe storage of wheat grain (1993)

- Wheat seed/grain (GW-1 variety) after having been dried under sunlight, coated with castor oil @ 500 ml/100 kg seed or mixed with dried neem leaves @ 2 kg/100 kg seeds can be stored safely in galvanized bins against lesser grain borer under Bhal conditions.

RAINFED GRAM

Release of variety (1999)

- Bold seeded variety GG-2 of chickpea is released from Arnej.

Optimum sowing time for wilt management gram (1992)

- Farmers of Bhal and Coastal zone are advised to adopt chickpea sowing during second fortnight of October (21-25 October) for minimizing the wilt disease and maximizing the crop yield (Net income Rs.3757/ha).

Seed rate and spacing requirement for Gram in Bhal region (1991)

- The farmers of Bhal region are advised to use 40 kg seeds/ha with inter row spacing of 30 cm for gram variety 'Chaffa'.

Use of Rhizobium culture in gram (1992)

- For getting maximum chickpea (var.Chaffa) yield, farmers of Bhal and Coastal Zone are advised to use *Rhizobium* culture GRS-4 (1×10^8 cells/g) @ 200g/8 kg seeds (ICBR 1:17.61).

Method of fertilizer application in Gram (1996)

- Gram (Chaffa) seeds @ 40 kg/ha mixed with fertilizer (10 Kg N + 20 Kg P₂O₅) can be sown under conserved soil moisture condition.

Irrigation x fertilizer study in gram (1993)

- For getting the economical yield of gram cv. 'Chaffa' under conserved moisture condition, an application of 20 kg N/ha is recommended to the farmers of Bhal Zone. Further, the farmers of Bhal and Coastal Zone be advised to give one irrigation of 50 mm from runoff harvested water to gram at maximum branching stage for securing higher yield and net realization per unit area if the facility for one irrigation is available. Under this condition he may go for higher dose of

nitrogen i.e. 40 kg N/ha for higher net return. Phosphorus application did not give response with or without irrigation.

Economic control of Gram pod borer (2000).

- The farmers of Bhal and Coastal Zone are advised to apply methyl parathion 2% dust @ 25 kg/ha (ICBR 1:2.78) OR Neem seed kernel suspension @ 5% (ICBR 1:6.61) at the appearance of the pest on gram crop for effective and economic control of pod borer, *Helicoverpa armigera* Hubner.

Economic control of powdery mildew in chickpea (1997)

- For effective and economic control of powdery mildew in chickpea, two sprays of Dinocap @ 0.025% or Wettable Sulphur @ 0.2% or Tridemorph @ 0.04% at an interval of 15 days starting from appearance of disease are recommended to the farmers of Bhal and Coastal Agroclimatic Zone.

SAFFLOWER

Variety (1994)

- Bhima variety of safflower was recommended for cultivation in Bhal and Coastal Agroclimatic Zone except Dhandhuka taluka.

Spacing requirement of safflower varieties (1996)

- The farmers of Bhal and Coastal Agroclimatic Zone are advised to grow safflower variety A-1 or Bhima at a geometry of 75cm x 15cm.

Fertilizer requirement of Safflower varieties (1996)

- The farmers of Bhal and Coastal Agro-climatic Zone are advised to fertilize safflower (variety A-1 or Bhima) with 25 kg N/ha. Safflower did not respond to applied phosphorus.

Effect of sources and levels of sulphur on seed and oil yield of Safflower (2000).

- The farmers of Bhal and Coastal Zone interested to grow Safflower are advised to apply sulphur @ 30 kg/ha to obtain higher yield and return. The sulphur may be applied through ammonium sulphate or gypsum or single super phosphate.

Response of safflower to bio-fertilizer (2001)

- The farmers of Bhal and Coastal Agro-climatic Zone interested to grow safflower are advised to inoculate the seeds with Azospirillum + Azotobactor in order to save half of nitrogenous fertilizer (12.5 kg N/ha).

Spacing and NP requirement of Safflower (Dhandhuka) (1994)

- The farmers of Bhal and Coastal Zone (AES 1A & 1B) are advised to grow Safflower at 45 cm or 60 cm row spacing. Application of N and P is not beneficial.

Saline water usage in Safflower (1999)

- It is recommended to the farmers of Bhal region that one irrigation of 50 mm depth at branching from harvested rain water to safflower increases the seed yield. Saline water use though increases the yield tends to deteriorate the soil health.

Use of Cycocel in Safflower (2000)

- Farmers of Bhal and Coastal Agro-climatic Zone, interested to grow safflower are advised to spray Cycocel @ 500 ppm at flower initiation or 50% flowering stage.

Optimization of safflower production under resource constraints (2001)

- The farmers of Bhal region growing safflower are advised to follow the recommended package of practices in order to get maximum return from the crop. Of the different inputs, plant protection is the most important and contributes maximum followed by fertilizers, population adjustment (thinning) and weed control in descending order.

Phosphorus management in safflower based cropping system (2001)

- The farmers of Bhal and Coastal Agro-climatic Zone following safflower-fodder sorghum rotation are advised to inoculate the seeds of both the crops with PSB (*Pseudomonas striata*) in order to save half of the dose of phosphorus.

Management of safflower aphid (1994)

- The safflower aphid (*Euroleucon compositae*) in Bhal region can effectively and economically be controlled by spraying Dimethoate 0.03% (ICBR 1:12.59) or Methyl-o-demeton 0.025% (ICBR 1:7.46) or Monocrotophos 0.04% (ICBR 1:7.33) or Phosphamidon 0.03% (ICBR 1:6.54).

➤ MUSTARD

Sowing time for mustard (1996)

- The farmers of Bhal and Coastal Agro-climatic Zone are advised to sow mustard between 10th and 20th October. In case, the maximum temperature around 10th October is found more than 35 °C, sowing should be performed

around 20th October.

Effect of bio-fertilizer, gypsum and nitrogen on growth and yield of mustard (2001)

- The farmers of Bhal and Coastal Agro-climatic Zone growing mustard under conserved moisture condition are advised to apply 1.0 t gypsum/ha for getting higher yield and net return.

Crop geometry for mustard (1999)

- The farmers of Bhal and Coastal Zone are advised to grow mustard at a crop geometry of 75 cm x 15 cm or 90 cm x 15 cm.

Limited irrigation in Mustard (1993)

- The farmers of Bhal and Coastal Agro-climatic Zone are advised to give one irrigation of 50 mm from runoff harvested water in farm pond to mustard at 30 DAS for securing higher yield (969 kg/ha) and net ICBR of 1:4.96). In case, monsoon is prolonged up to October, there is no need to irrigate the mustard crop.

Irrigation x Fertilizer study in mustard (1997)

- The farmers of Bhal and Coastal Agro-climatic Zone are advised to fertilize mustard with 60 kg N/ha for obtaining economic yield under conserved moisture conditions. In case of harvested rain water availability crop should be irrigated at 30 DAS with 50 mm of water and fertilize with 60 kg N + 20 kg P₂O₅/ha.

Management of powdery mildew in mustard (1996)

- For effective management of powdery mildew of mustard, two sprays of 0.2% Wetteble sulphur (ICBR 1:11.69) or 0.4% Tridemorph (ICBR 1:5.44) or 0.025% Dinocap (ICBR 1:4.99) at 15 days interval starting from appearance of disease are recommended for the farmers of Bhal and Coastal Agroclimatic Zone.

DILLSEED

Release of variety (2001)

- Release of new variety of dill seed (GD-2) for rainfed farming based on results of Arnej center i.e. screening of the variety in the salt affected soils under rain fed conditions.

Crop geometry for dillseed (1999)

- The farmers of Bhal and Coastal Zone are advised to grow dillseed at a crop geometry of 75 cm x 30 cm.

Effect of graded levels of nitrogen and phosphorus on yield of dillseed under limited irrigation conditions (2007).

- Farmers of Bhal and Coastal Zone are advised to sow the dillseed giving one irrigation of 50 mm after 30 DAS fertilized with 20 kg N ha⁻¹ and 20 kg P₂O₅ ha⁻¹ as basal application and 20 kg N ha⁻¹ as top dressing after irrigation to secure higher yield and better returns. While, under conserved moisture condition, farmers should apply only 40 kg N ha⁻¹ as basal application at the time of sowing.

RABI CROPS

Limited irrigation in rabi crops (2003)

- Farmers of *Bhal* and Coastal Zone growing *rabi* crops under conserved moisture or under supplementary irrigation are advised to put their first preference to wheat crop, followed by gram and dill seed for getting higher crop yield and higher income. In case of availability of good quality water they are advised to irrigate their crop up to twice (50 mm each) for getting higher yield and income without affecting the soil health.

RAINFED COTTON

Time of sowing for Cotton (1997)

- The farmers of Bhal and Coastal Zone should sow the cotton crop at the onset of monsoon but not later than first week of August.

Receding soil moisture in Cotton var. G.Cot.13 (1993)

- In the Bhal and Coastal Agroclimatic Zone cotton should be sown when the soil moisture is around 24% for securing adequate germination. In case the sowing is delayed, the farmers are advised to sow even upto 14% moisture level but with increasing the seed rate by 50%. This level of moisture under field conditions will be obtained 25-30 days after the inception of monsoon.

Use of composted farm waste and N in rainfed cotton under limited irrigation (2002)

- Farmers of Bhal and Coastal Zone growing cotton, are advised to grow cotton

(G.Cot.13) with Composted Farm Waste @ 10 t/ha (applied in furrow) and nitrogen @ 40 kg/ha as basal under two irrigation for getting about 65 per cent higher seed cotton yield over rainfed. They are advised to irrigate the crop at 20 days and 42-43 days after cessation of monsoon (i.e. 75% ASMD).

Time of potassium application in rainfed cotton (2003)

- Farmers of *Bhal* and Coastal Zone growing rainfed *herbacium* cotton are advised to apply potassium @ 20 kg K₂O ha⁻¹ at 6 cm soil depth adjacent to cotton row after withdrawal of monsoon for getting higher yield of seed cotton and higher net income.

Spacing requirement for Cotton (1996)

- The farmers growing rainfed cotton (G.Cot.13) in *Bhal* and Coastal Agro-climatic Zone are advised to adopt an inter row spacing ranging from 120cm to 200cm depending upon the availability of bullock or tractor drawn implements.

Saline water usage in Cotton (1999)

- Farmers of *Bhal* and Coastal Zone (AES 1B) growing Cotton G.Cot.13 can apply two irrigations of saline water (upto 8 ds/m at 30 and 45 days after withdrawal of monsoon for sustaining seed cotton yield during drought years. Where source of harvested rainwater is available, out of two irrigations, first one may be applied from harvested rain water.

Studies on inter cropping in cotton G.Cot.13 (2001)

- The farmers of *Bhal* and Coastal Agro-climatic Zone cultivating cotton in wider spacing are advocated to take soybean as an intercrop for raising their monetary benefit.

Intercropping in rainfed Cotton (1991)

- It is recommended that the farmers of *Bhal* region are advised to adopt intercropping of green gram or black gram in paired row system of planting cotton G.Cot.13 variety for getting higher additional realization.

PIGEON PEA

Spacing requirement of Pigeon pea (1991)

- It is recommended that Pigeonpea can be grown at 60 cm or 75 cm interrow spacing in the *Bhal* and Coastal Agroclimatic Zone.

Management of Heliothis in Pigeonpea (2000)

- For effective and economic control of pigeonpea pod borer (*H.armigera*), farmers of Bhal and Coastal Zone are advised to apply methyl parathion 2% dust either two times i.e. first at 50% flowering and second at 50% pod formation (ICBR 1:9.33) or three times i.e. first at the initiation of flowering, second at 50% flowering and third at pod formation (ICBR 1:6.83).

CASTOR

Fertilizer requirement of Castor (1992)

- The farmers of Bhal and Coastal Agroclimatic Zone are advised to apply 25 kg N/ha to castor crop to obtain seed yield of 620 kg/ha (NICBR 1:1.05).

TRANSPLANTED PADDY

Fertilizer requirement of Paddy (1995)

- For transplanted paddy (SLR 51214) an application of 10 t FYM + 150 kg N/ha is recommended to the farmers of Bhal and Coastal Agro-climatic Zone. However, in case of short supply of fertilizer or due to poor economical condition of farmers, one may go for 10 t FYM + 100 kg N/ha.

FODDER SORGHUM

Response of *kharif* sorghum varieties to nitrogen and phosphorus (1990)

- The farmers of Bhal and Coastal Agro-climatic Zone are advised to apply 15 kg N and 15 kg P₂O₅/ha to fodder sorghum variety Trapaj as basal application to get net ICBR 1:7.1 and 1:1.8, respectively.

Fertilizer requirement of *kharif* fodder sorghum GFSH-1 (1998)

- Farmers of Bhal and Coastal Agro-climatic Zone (AES II) growing fodder sorghum (var.GFSH-1) under rainfed situation are advised to apply 40 kg N and 10 kg P₂O₅ /ha for doubling the yield in soils of low N and P status.

Effect of levels of nitrogen and phosphorus on ‘Solapuri’ sorghum under conserved moisture (2004).

- The farmers of Bhal and Coastal Agro-climatic Zone who are growing fodder sorghum var ‘ Solapuri’ under conserved moisture condition during rabi season, are advise to apply 30 kg N + 15 kg P₂O₅/ha for getting higher yield and economics.
- **Evaluation of different genotypes of sorghum under different planting time (*Rabi*).**

Farmers of Bhal and Coastal Zone are advised to sow sorghum variety viz. SSG 59 3 on 15th October to obtain higher green forage and dry fodder yields and better returns under conserved moisture condition in *Rabi* season. In case of delayed sowing (15th November) condition, variety Solapuri should be preferred.

GRASSES

Relative performance of different grasses and their effect on soil reclamation (2001)

- The farmers of Bhal and Coastal Agro-climatic Zone are advised to grow either *Dichanthium* or *Gutton panic* for forage on their marginal lands.

Spacing and N management study in gutton panic (1999)

- The Farmers of Bhal and Coastal Zone who are interested to grow *gutton panic* are advised to plant the grass at the geometry of 45 cm x 30 cm or 30 cm x 30 cm and fertilize with 75 kg N/ha/year.

Saline water irrigation in grasses (1996)

- Farmers of Bhal and Coastal Zone having insufficiency of fodder grass for their cattle, particularly during drought period, can grow “*Gutton panic*” or *Dichanthium* grass through saline water irrigation (upto 8 ds/m). After every three years they are advised to change the site.

CONTINGENT PLANNING

Contingent planning of *kharif* crops under vagaries of monsoon (2001)

- Under normal monsoon (June-July), the farmers of Bhal and Coastal Agro-climatic Region should prefer cotton, whereas under delayed monsoon (after July) fodder sorghum gives better returns.

LAND CONFIGURATION

Water Management Through Land configuration (1996)

- Farmers of Bhal and Coastal Zone are advised to adopt raised (15cm above surface) and sunken (15cm below surface) bed system (6m width) of cultivation for getting higher benefit in terms of substantial yield of *kharif* and *rabi* crops. They are advised to grow cotton on raised beds during *kharif* and wheat or gram on sunken beds during *rabi* for securing higher income (ICBR 1:2.39).

HORTICULTURE & AGRO-FORESTRY

Biodesalinization of soil through *Prosopis juliflora* (1992)

- The farmers are advised to grow *Prosopis juliflora* in salt affected soil for 6 to 7 years so as to reduce the total salt concentration (EC 2.5) from 0.95 to 0.38 ds/m and ESP from 24.5 to 6.7 with increase in the infiltration rate from 0.25 to 0.53.

Recommendation on Arid fruit (1992)

- The farmers of Bhal and Coastal Zone are advised to adopt the ber variety 'Gola' under rainfed conditions to obtain a net return of Rs.16575/ha (ICBR 1:5.25).
- The crop should be fertilized with 500 g castor cake and 50g DAP per pit before planting and 50g DAP and 75g Urea every subsequent years.

Reclamation of saline-sodic soils (1996)

- For improving saline-sodic/waste soil to cultivable land, farmers of Bhal and Coastal Zone are advised to grow *Prosopis juliflora* or *Acacia tortilis* or *Azadirachta indica* forest species for a period of 6-7 years. They are also benefitted with the fuelwood after 6-7 years besides improving the land. In case of non-availability of the above species, farmers may go in for *Salvadora spp.* As that also gives fodder/fuel and seeds containing high value oil.
- Forest tree species like *Albizia lebbek*, *Moringa oleifera*, *Sesbania egyptica*, *Tecomella undulata*, *Atriplex halimus*, *Casurina spp.* and Eucalyptus hybrid have shown very low to no adaptability.

Mulching in Ber var. 'Gola' (2003)

- Farmers of Bhal and Coastal Zone growing ber (var. Gola) in poor land under rainfed situation, are advised to adopt surface mulching techniques just after cessation of monsoon with wheat husk (Dantha) spreading around plant up to 2 m with thickness of 5 cm for securing higher yield and higher additional income.

AGRICULTURAL ENGINEERING

Use of LDPE sheet as lining material in dugout pond (1995)

- In Bhal region, for minimizing the loss of stored water from the dugout pond, the depth of pond should be of 1.5 m. LDPE sheet (100 micron) can be used as a lining material in dugout pond to reduce further seepage loss of stored water.

Bullock drawn automatic seed-cum-fertilizer drill (1998)

- Bullock drawn automatic seed cum fertilizer drill is designed, tested and recommended for Bhal and Coastal Zone for uniform placement of seeds of wheat and gram with fertilizer, at different depths under conserved moisture farming.

Method of sowing(2006)

- The farmers of the Bhal area are advised to use the ridge former attachment for drilling the cotton seeds on the ridges in order to save the seedlings from the stagnation of rainwater in the field for getting requisite plant population and higher cotton yield.

Deep tillage for moisture conservation (2007)

- The farmers of the Bhal area are advised to perform deep tillage up to 30 cm with mould board plough at conducive field condition for tillage after considerable rainfall in the month of June in order to conserve more soil moisture in black soil in Bhal region and subsequently higher grain yield of wheat as compared to that under conventional tillage.

Well recharging in Bhal region(2007)

- The farmers of the Bhal area are advised to use the tube well recharging system adopting 10.5 m deep bore well having 10 cm diameter with sand stone filter made of five layer, each of 30 cm thickness made of various sized stones, aggregates and coarse sand for filtering the run off water available during rainy season from five hectares of land to recharge and improve the quality of water. The farmers can obtain about 45 to 50 per cent additional yield and income by utilizing recharged water

Evaluation of Ground Water Recharging Systems to Develop Suitable System for Bhal Region(2008)

Among recharging systems, recharging through dug well with filter is recommended for increasing the quantum of underground water reservoir at a higher rate in large scale for benefit of the farmers of Bhal area. Construction of dug well with filter in any natural depression or a constructional pond is suitable in order to raise the underground water table at much more higher rate of recharge.