

IMPROVED CROP PRODUCTION TECHNOLOGIES FOR HIGHER AND SUSTAINED YIELD OF GROUNDNUT

(Technologies generated through AICRP on Groundnut)



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Preface

India ranks first in area, and second in production of groundnut in the world. However, the average productivity of groundnut in India is only 1367 kg ha⁻¹ which is far below as compared to that in other countries like USA, China, Indonesia, Myanmar *etc.* as well as world average. Groundnut is most important oilseed crop in India after soybean and rapeseed and mustard. The main factors for low yield of groundnut in India are: cultivation under rainfed conditions (~80 percent), non-availability of short duration varieties resistant to biotic and abiotic stresses; low seed replacement rate due to factors like low seed multiplication ratio (1:8), use of poor quality seed, rapid loss of seed viability particularly in *rabi*-summer produce; cultivation of groundnut on low fertility soils; lack of balanced nutrition; incidence of diseases (like stem rot, collar rot, leaf spot, leaf blight & wilt) and insect-pests (like white grub, termite, foliage eaters) *etc.* Besides, lack of proper marketing facilities deprives farmers to get proper price of their produce thereby discouraging them to invest for improved production technologies. High labour and other input cost has also eroded profitability of farmers.

For high and sustained production, improved profits, and conserve natural resources there is need for paradigm shift in production technology of groundnut. Since most of the groundnut in India is produced under rainfed conditions, adoption of moisture conservation practices by farmers is paramount to offset the consequences of moisture stress at one or other stage of growth and development of crop. Since groundnut has the unique growth habit of having cultivars which fall into different groups viz., bunch, semi-spreading, and spreading types; therefore, it is important for farmers to have the proper knowledge of right seed rate and planting geometry of the variety selected to avoid yield penalties. As groundnut responds well to residual soil fertility following proper nutrient management practices not only in groundnut crop but also in crops in rotation is vital to realize full yield potential of groundnut. Judicious use of chemical fertilizers is essential for higher input use efficiency and higher yield; for example, many farmers (e.g. in Saurashtra, Gujarat) are in the practice of top dressing of urea or ammonium sulphate about 30-45 days after sowing which leads to excessive vegetative growth thereby affecting peg entry and pod setting. Similarly, under-fertilization is one of the major limiting factors to realize full yield potential of groundnut in other regions.

As groundnut is particularly susceptible to weed preponderance due to its smaller canopy, wider spacing between the rows, and initial slow growth; carrying out weed control timely and effectively is essential to get higher yield. Promotion of need based farm mechanization is required not only to reduce farm drudgery but also to reduce cost of cultivation and get higher yields. A sizeable proportion of groundnut area is in light black soils (e.g. in Saurashtra, Gujarat) which have low yield potential for groundnut despite adoption of best management practices, therefore, amending such soils by mixing tank silts, river bed sand or organic manures is required to get higher yield of groundnut. Promoting the concept of seed village and scientific storage facilities is essential to improve the need based availability of quality seed to groundnut growers on timely basis.

AICRP-Groundnut is an important platform for carrying out research on various aspects of groundnut under different agro-climatic conditions in the country. This compilation of AICRP-Groundnut recommendations emerged from research conducted over last 15 years by different centres, is an effort to bring the information at one place so that the stakeholders (farmers, policy makers, researchers, university students *etc.*) can have ready access.

(Radhakrishnan, T.)
Director, ICAR-DGR

Table of Contents

S. No	Centre	Name of the technology	Page No.
1	Akola	<ol style="list-style-type: none"> 1. Water soluble foliar grade fertilizers (WSGF) for improved growth and yield of summer groundnut 2. Optimum ratios and levels of nitrogen and phosphorus for <i>kharif</i> groundnut 3. Optimum fertilizer doses and plant population under check basin method of irrigation for summer groundnut 4. Integrated phosphorus management for higher productivity and profitability of <i>kharif</i> groundnut 	1-2
2	Bhubaneswar	<ol style="list-style-type: none"> 1. Optimum tillage and sowing methods for rice-groundnut system 2. Nutrient management practices for production maximization in <i>rabi</i>-summer groundnut 3. Weed management in rain-fed groundnut 4. Sulphur and calcium management through application of gypsum in rainfed groundnut 5. Integrated nutrient management in rice-groundnut cropping system 6. Nutrient management practices for production maximization in <i>kharif</i> groundnut 7. Suitable land configuration and mulching on higher productivity and resource use efficiency in <i>kharif</i> groundnut 8. Optimum fertilizer doses and plant population under check basin method of irrigation for summer groundnut 9. Mulching, hydrogel and nutrient management for productivity of summer groundnut 10. DAPG-producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of <i>kharif</i> groundnut 11. DAPG- producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of <i>rabi</i>-summer groundnut 12. Integrated phosphorus management for higher productivity and profitability of <i>kharif</i> groundnut 	3-7

3	Bikaner	<ol style="list-style-type: none"> 1. DAPG- producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of groundnut 2. Integrated phosphorus management for higher productivity and profitability of <i>kharif</i> groundnut 	8
4	Dharwad	<ol style="list-style-type: none"> 1. Skip row planting of groundnut under rainfed condition 2. Seed inoculation with plant growth promoting rhizobacteria (PGPR) 3. Soil application of ferrous sulphate @ 25.0 kg/ha 4. Foliar application of water-soluble foliar grade fertilizer in summer groundnut 5. Nutrient management in groundnut + Bt-cotton intercropping system. 6. DAPG-producing fluorescent pseudomonads for enhance nutrient use efficiency, bio-control of soil-borne diseases and yield of groundnut 7. Integrated phosphorus management for higher productivity and profitability of <i>kharif</i> groundnut 	9-13
5	Durgapura	<ol style="list-style-type: none"> 1. Land configuration and mulching for <i>kharif</i> groundnut 2. Zinc application in groundnut-wheat cropping system 3. Optimization of plant density and fertilizer doses in groundnut+cluster bean intercropping 4. Organic manures, bio-fertilizers and bio-pesticide for confectionary groundnut 5. Seed treatment for yield maximization in <i>kharif</i> groundnut 6. Field efficacy of PGPRs and their agri-formulation on groundnut crop yield under semi-arid agro-ecosystem 7. Integrated weed management in <i>kharif</i> groundnut 8. Growth hormones for <i>kharif</i> groundnut 9. Management of sulphur and calcium through application of gypsum in irrigated confectionery groundnut 10. Nutrient management practice for yield maximization in <i>kharif</i> groundnut 11. Drip irrigation in <i>kharif</i> groundnut for higher yield and nutrient use efficiency 	14-21

		<ol style="list-style-type: none"> 12. Optimum irrigation levels and hydrogel levels for higher productivity of <i>kharif</i> groundnut 13. DAPG-producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of <i>kharif</i> groundnut 14. Integrated phosphorus management for higher productivity and profitability of <i>kharif</i> groundnut 	
6	Gwalior	<ol style="list-style-type: none"> 1. Response of <i>kharif</i> groundnut to plant geometry and fertility levels 2. Application of bio-formulations in <i>kharif</i> groundnut production 	22
7	Jagtial	<ol style="list-style-type: none"> 1. Bio-fertilizers for high productivity of groundnut under rice fallows 2. Post-emergence herbicides for weed control in groundnut 3. Nutrient management practices for yield maximization in <i>kharif</i> groundnut 4. Nutrient management practices for production maximization in <i>rabi</i>/summer groundnut 5. Water soluble foliar grade fertilizers for higher growth and yield of groundnut during <i>rabi</i>/summer 6. Mulching, hydrogel and nutrient management in summer groundnut 7. Nutrient management practices for yield maximization in <i>rabi</i>/summer groundnut 8. Fertilizer doses and optimum plant population for <i>rabi</i>/summer groundnut under drip irrigation 	23-26
8	Jalgaon	<ol style="list-style-type: none"> 1. Nutrient management practices for production maximization of summer groundnut 2. Management of sulphur and calcium through application of gypsum in rainfed groundnut 3. Scheduling of irrigation in groundnut during <i>rabi</i>/summer 4. Nutrient management practices for yield maximization in <i>kharif</i> groundnut 5. Irrigation management and hydrogel in <i>kharif</i> groundnut 	27-30

		<ol style="list-style-type: none"> 6. Nutrient management in prevalent groundnut-based cropping system 7. Fertilizer doses and plant population under drip fertigation for <i>rabi</i>/summer groundnut 8. Mulching, hydrogel and nutrient management for higher productivity of summer groundnut 9. DAPG-producing fluorescent pseudomonads for enhancing nutrient use efficiency, bio-control of soil-borne diseases and higher yield of <i>kharif</i> groundnut 10. DAPG-producing fluorescent pseudomonads for enhancing nutrient use efficiency, bio-control of soil-borne diseases and higher yield of <i>rabi</i>/ summer groundnut 11. Integrated phosphorus management for higher productivity and profitability of <i>kharif</i> groundnut 	
9	Junagadh	<ol style="list-style-type: none"> 1. Optimum plant density and fertilization for groundnut-pigeon pea relay cropping system 2. Use of post- emergence herbicides in <i>kharif</i> groundnut 3. Maintenance of optimum plant density of groundnut under rainfed condition 4. Nutrient management practices for yield maximization in groundnut 5. Management of sulphur through application of gypsum in rainfed groundnut 6. Organic and bio-fertilizers, and bio-pesticides for organic groundnut production during <i>kharif</i> 7. Nutrient management and plant protection for organic groundnut production during summer 8. Drip irrigation system in summer groundnut. 9. Nutrient management in groundnut-Bt. cotton intercropping system 10. Water soluble foliar grade fertilizers for summer groundnut 11. Optimum irrigation levels and hydrogel for higher productivity of <i>kharif</i> groundnut 12. Resource optimization for higher monetary benefits in <i>kharif</i> groundnut 	31-40

		<ul style="list-style-type: none"> 13. Nutrient management practices for yield maximization in <i>kharif</i> groundnut 14. Nutrient management practices for maximization of yield in summer groundnut 15. Nutrient management in prevalent groundnut-based cropping system 16. Fertilizer doses and plant population for summer groundnut under fertigation 17. DAPG-producing fluorescent pseudomonads for enhancing nutrient use efficiency, bio-control of soil-borne diseases and yield of <i>kharif</i> groundnut 18. DAPG- producing fluorescent pseudomonads for enhancing nutrient use efficiency, bio-control of soil-borne diseases and yield of summer groundnut 19. Integrated phosphorus management in groundnut for higher P use efficiency 	
10	Kadiri	<ul style="list-style-type: none"> 1. Groundnut cultivars for late sown conditions 2. Effective weed management in <i>kharif</i> groundnut 3. Use of post-emergence herbicides in groundnut. 4. Nutrient management practices for yield maximization in groundnut 5. Maximization of <i>kharif</i> groundnut production under resource constraint situation 	41-43
11	Puducherry	<ul style="list-style-type: none"> 1. Paclobutrazol on growth and yield of <i>kharif</i> groundnut 2. Tank mix application of post-emergence herbicides for efficient weed control in <i>rabi</i>/summer groundnut 	44-45
12	Rahuri	<ul style="list-style-type: none"> 1. Water soluble foliar grade fertilizers in groundnut. 2. Nutrient management practices for production maximization in <i>rabi</i>/summer groundnut 3. Fertilizer doses and plant population for <i>rabi</i>/summer groundnut 	46-47
13	Shirgaon	<ul style="list-style-type: none"> 1. Tillage and sowing options for <i>rabi</i>-summer groundnut 2. Micronutrient management in <i>kharif</i> groundnut 3. Effective weed control in <i>rabi</i> groundnut 4. Nutrient management practices for production maximization of <i>rabi</i> groundnut 	48-58

		<ol style="list-style-type: none"> 5. To optimize <i>kharif</i> groundnut production under resource constraint conditions 6. Water soluble foliar grade fertilizers in groundnut. 7. Pre-germinated seeds for higher germination in <i>kharif</i> groundnut 8. Nutrient management in groundnut-rice cropping system 9. Suitable land configuration and mulching for <i>kharif</i> groundnut 10. Nutrient management practices for yield maximization in <i>kharif</i> groundnut 11. Water soluble foliar grade fertilizers (WSGF) for <i>rabi</i> / summer groundnut 12. Fertilizer doses and plant population for summer groundnut 13. Mulching, hydrogel and nutrient management for summer groundnut 14. DAPG-producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of <i>kharif</i> groundnut 15. DAPG- producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of summer groundnut 16. Integrated phosphorus management in <i>kharif</i> groundnut 17. Optimization of <i>rabi</i> groundnut under resource constraints 	
14	Tindivanam	<ol style="list-style-type: none"> 1. DAPG- producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of <i>kharif</i> 2. Tank mix application of post-emergence herbicides for efficient weed control in <i>kharif</i> groundnut 3. Integrated phosphorus management in <i>kharif</i> groundnut 	59-60
15	Tirupati	<ol style="list-style-type: none"> 1. DAPG- producing fluorescent pseudomonads for nutrient use efficiency, bio-control of soil-borne diseases and yield of <i>kharif</i> groundnut 2. Tank mix application of post-emergence herbicides for efficient weed control in <i>kharif</i> groundnut 	61-62

		<ol style="list-style-type: none"> 3. Integrated phosphorus management in <i>kharif</i> groundnut 4. DAPG- producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of <i>rabi</i> groundnut 	
16	Vriddhachalam	<ol style="list-style-type: none"> 1. Nutrient management practices for production maximization in <i>rabi</i>/summer groundnut 2. Post emergence herbicide for groundnut 3. Seed drill sowing and seed treatment for irrigated groundnut 4. Split application of fertilizers to irrigated groundnut 5. Nutrient management in prevalent groundnut-based cropping system 6. Tank mix application of post-emergence herbicides for efficient weed control in <i>kharif</i> groundnut 7. DAPG-producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of <i>kharif</i> groundnut 8. Integrated phosphorus management in <i>kharif</i> groundnut 	63-65

Sr. No.	List of Figures	Page No.
1	Skip row planting of groundnut under rainfed condition	9
2	Groundnut under rainfed condition with PGPR seed treatment	10
3	Typical iron deficiency (L) and crop with soil application of ferrous sulphate @ 25.0 kg/ha at farmers' field (R)	11
4	Application of recommended dose of nutrients (L) and application of recommended dose of nutrients along with water soluble foliar grade fertilizer (R)	12
5	Application of 50% recommended dose of phosphorus (37.5 kg ha ⁻¹)+DGRC culture (L) and recommended dose of phosphorous (R)	13
6	Groundnut (L) and wheat (R) with zinc application	14
7	Groundnut under weed free condition (L) and groundnut under weedy check plot (R)	17
8	Experts discussing importance of gypsum application in groundnut at farmers' field	19
9	Groundnut under weed free condition (L) and groundnut under weedy check plot (R)	23
10	Groundnut + Pigeonpea intercropping in 2:1 ratio (L) and sole groundnut at 60 x10 cm spacing (R)	31
11	Groundnut crop treated with pendimethalin 30 EC (L), Pendimethalin 30 EC + quizalofopethyl 5 EC (C) and Control (R)	32
12	Crop with 100% RDF as basal dose + 50% RDF as top dressing at 30 DAS (L) and 100% RDF as basal dose control (R)	33
13	Crop with application of gypsum @ 400 kg/ha (L) and control (R)	34
14	Application of 100% N +125 % P (12.5-31.25-0 NPK kg/ha) to groundnut (L) and application of 100% RDF (120-60-40 NPK kg/ha) to wheat crop (R)	39
15	Groundnut cultivars for late sown conditions at Kadiri	41
16	Technologies for resource constraint conditions in groundnut at Kadiri	43
17	Effect of paclobutrazol spray in groundnut	44
18	Pre- emergence application of Pendimethalin @ 1.5 kg a.i/ha (PE) followed by tank mix application of 50 % of each of Imazethapyr @ 37.5 g a.i/ha+Quizalopfop ethyl @ 25g a.i/ha at20-30 DAS (L) and Weedy check (Control) (R)	45
19	Effect of pre-emergence weedicide and one hand weeding on weed control	49
20	Effect of pre-emergence weedicide and post-emergence weedicide on weed control	49
21	Groundnut with application of 100% RDF at sowing and 50% RDF as top dressing	50
22	Production technologies for higher yield of groundnut under resource constraint conditions of Shirgaon	51
23	Effect of foliar application of water-soluble fertilizers in groundnut	52
24	Effect of different treatments on germination in groundnut	53
25	Field performance of rice-groundnut cropping system	54
26	Different land configuration and mulching techniques used in groundnut	55
27	Impact of seed treatment with DAPG 4 in groundnut	59
28	Herbicide spray and its impact on groundnut	60
29	Application of 5 t FYM/ha + 50 kg P ₂ O ₅ /ha + seed treatment with DGRC 2 and its effect in groundnut	60

AICRPG Center-Akola

Technology 1: Water soluble foliar grade fertilizers (WSGF) for improved growth and yield of summer groundnut

- **Duration:** *rabi*/summer 2011-12 to 2013-14
- **Scientists involved:** Dr. PV Mahatale, Dr. MY Ladole and Dr. SN Deshmukh
- **Recommendation domain:** Central Vidarbha zone of Maharashtra (Zone VIII).
- **Existing practices:** No use of water soluble fertilizer in groundnut
- **Technology description:** Use of FYM @ 7.5 t/ha and 100% RDF as basal and foliar spray of WSGF @ 2% of starter dose 11:36:24 kg NPK/ha at 30 DAS and booster dose of 8:16:39 kg NPK/ha at 45 and 60 DAS.
- **Impact:** Improves pod yield (9.8%) and net returns by Rs.18838/ha

Technology 2: Optimum ratios and levels of nitrogen and phosphorus for *kharif* groundnut

- **Duration:** *kharif* 2012 to 2014
- **Scientists involved:** Dr. PV Mahatale, Dr. MY Ladole and Dr. SN Deshmukh
- **Recommendation domain:** Central Vidarbha zone of Maharashtra (Zone VIII)
- **Existing practices:** Use of RDF 25:50:00 kg NPK/ha
- **Technology description:** Application of NP @ 30:75 kg/ha in the ratio of 0.40 along with recommended dose of potassium
- **Impact:** Improves pod yield (17.1%) and net returns by Rs.15275/ha

Technology 3: Optimum fertilizer doses and plant population under check basin method of irrigation for summer groundnut

- **Duration:** *rabi*/summer 2013-14 to 2015-16
- **Scientists involved:** Dr. PV Mahatale, Dr. MY Ladole and Dr. ER Vaidya
- **Recommendation domain:** Central Vidarbha zone of Maharashtra (Zone VIII)
- **Existing practices:** Sowing at 30 x 10 cm spacing (3.33 lakh plants/ha) with 25:50:25 kg/ha of NPK (100 percent)
- **Technology description:** Sowing at 20 x 10cm spacing (5.00 lakh plants/ha) with application of 31.25:62.50:31.25 kg/ha of NPK (125 percent RDF)
- **Impact:** Higher plant stand and application of 125 percent NPK increased pod yield and net returns by 15 and 22 percent, respectively

Technology 4: Integrated phosphorus management for higher productivity and profitability of *kharif* groundnut

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. PV Mahatale, Dr. MY Ladole and Dr. ER Vaidya
- **Recommendation domain:** Central Vidarbha zone of Maharashtra (Zone VIII)
- **Existing practices:** Application of 50 kg/ha of P (100 % P)
- **Technology description:** Application of 5.0 t FYM/ha + 100 % P + DGRC1 bio-culture is recommended
- **Impact:** Increased dry pod yield by 24 percent

AICRPG Center-Bhubaneswar

Technology 1: Optimum tillage and sowing methods for rice-groundnut system

- **Duration:** 2009-10 to 2011-12
- **Scientists involved:** Dr. HK Patro
- **Recommendation domain:** East & south-east coastal plain zone of Odisha
- **Existing practices:** Sowing of seeds behind the plough/tractor and tillage with bullock plough or tractor. Puddling is practiced in case of rice.
- **Technology description:** Field can be prepared with rotavator or conventional or zero tillage practices and paired row (20/30 x 20 cm) method of sowing is recommended in groundnut.
- **Impact:** In case of tillage, 2.5% increase in pod yield and 7% increase in net return by ploughing rotavator over conventional tillage. Among methods of sowing, paired row (20/30 x 20 cm) recorded 25.4% more yield and Rs. 39662/ha net return over control.

Technology 2: Nutrient management practices for production maximization in *rabi*-summer groundnut

- **Duration:** *rabi*/summer 2009-10 to 2011-12
- **Scientists involved:** Dr. HK Patro
- **Recommendation domain:** East & south-east coastal plain zone of Odisha
- **Existing practices:** Basal application of RDF (20-40-40) N, P₂O₅, K₂O without FYM
- **Technology description:** Application of 100% recommended dose of fertilizers (RDF) + FYM @ 7.5 t ha⁻¹ as basal + 50% RDF as top dressing at 30 DAS
- **Impact:** Application of 100% recommended dose of fertilizers (RDF) + FYM @ 7.5 t ha⁻¹ as basal + 50% RDF as top dressing at 30 DAS produced 57% more yield and net return of Rs. 26905/ha over control (RDF)

Technology 3: Weed management in rainfed groundnut

- **Duration:** *kharif* 2010 to 2012
- **Scientists involved:** Dr. HK Patro
- **Recommendation domain:** Western central table land and east & south eastern coastal plain rainfed groundnut under alluvial and laterite soil
- **Existing practices:** Hoeing at 20 DAS without any herbicide application
- **Technology description:** Application of pre-emergence herbicides pendimethalin 30 EC @ 1 kg a.i. ha⁻¹ followed by application of quizalofop ethyl 5 EC @ 50 a. i. ha⁻¹ at 20 DAS along with one hand weeding at 45 DAS is effective and economical for weed control in rainfed groundnut
- **Impact:** In case of labour shortage, combined application of pre- and post-emergence

herbicide i.e pendimethalin 30EC @ 1 kg a.i./ha followed by either quizalofop ethyl 5EC @ 50 a.i./ha at 20AS or Imazethapyr 10WC @ 75 g a.i./ha at 20 DAS along with one hand weeding is equally effective in terms of weed control and higher groundnut productivity

Technology 4: Sulphur and calcium management through application of gypsum in rainfed groundnut

- **Duration:** *kharif* 2010 to 2012
- **Scientists involved:** Dr. HK Patro
- **Recommendation domain:** Western central table land and east & south-east coastal plain zone of Odisha
- **Existing practices:** Use of gypsum at a very low rate
- **Technology description:** Split application of gypsum @ 600 kg ha⁻¹ i.e. 50% at basal and 50% on 45 DAS
- **Impact:** Split application of gypsum i.e. 50% as basal and 50% on 45 DAS recorded 12% increase in yield and net return of Rs. 20864/ha over basal application of entire dose of gypsum in groundnut cultivation

Technology 5: Integrated nutrient management in rice-groundnut cropping system

- **Duration:** *kharif* 2010 to 2012
- **Scientists involved:** Dr. HK Patro
- **Recommendation domain:** East & south-east coastal plain zone of Odisha
- **Existing practices:** Application RDF to paddy and groundnut separately
- **Technology description:** Under rice-groundnut system, application of 60 kg N ha⁻¹ to rice and 40 kg P₂O₅ ha⁻¹ to groundnut is recommended
- **Impact:** The results indicated that significantly higher total groundnut equivalent yield of the system (3281 kg/ha) and B:C ratio (2.48) was noted with the nutrient management practices involving applications of recommended nitrogen fertilizer @ 60 kg/ha to rice and recommended phosphorous fertilizer @ 40 kg P₂O₅/ha to the succeeding groundnut crop in rice-groundnut cropping system

Technology 6: Nutrient management practices for production maximization in *kharif* groundnut

- **Duration:** *kharif* 2010 to 2012
- **Scientists involved:** Dr. HK Patro
- **Recommendation domain:** East & south-east coastal plain zone of Odisha
- **Existing practices:** No application of micronutrients
- **Technology description:** Application of FYM @ 7.5 t ha⁻¹ + RDF along with soil application of critical micronutrients and foliar application of urea @ 2% at 30 and 60 DAS

- **Impact:** The combined application of FYM plus recommended dose of NPK with urea foliar application twice recorded 10% increase in yield and net return of Rs 10359/ha over control

Technology 7: Suitable land configuration and mulching on higher productivity and resource use efficiency in *kharif* groundnut.

- **Duration:** *kharif* 2013 to 2015
- **Scientists involved:** Dr. HK Patro and Dr. SK Swain
- **Recommendation domain:** East & south-east coastal plain zone of Odisha
- **Existing practices:** In normal field condition without any mulch
- **Technology description:** Use of broad bed and furrow (1 m width x 50 cm furrow) or raised bed and furrow (60cm width x 30 cm furrow) method of groundnut sowing with mulch (organic or polythene) is recommended for obtaining high yield and monetary returns from *kharif* groundnut
- **Impact:** Higher yield (25-28%), net realization (₹10653-₹11373/ha) and BCR (2.12-2.13) from *kharif* groundnut. Among land configuration methods broad bed & furrow recorded significantly 30% higher pod and net return (Rs. 41572 /ha) compared to other methods. Similarly application of organic mulch (7.5 t FYM/ha) produced significantly 8.3% higher pod yield and net return (Rs. 38855/ha) over control

Technology 8: Optimum fertilizer doses and plant population under check basin method of irrigation for summer groundnut.

- **Duration:** *rabi*/summer 2013-14 to 2015-16
- **Scientists involved:** Dr. HK Patro and Dr. SK Swain
- **Recommendation domain:** East & south-east coastal plain zone of Odisha
- **Existing practices:** Sowing at 30cm x 10cm spacing (3.33 lakh plants/ha) with 100% RDF (20:40:40 kg NPK/ha)
- **Technology description:** Groundnut sowing at plant spacing of 25cm x 10cm (4.00 lakh plants/ha) with 125% RDF (25:50:50 kg NPK/ha)
- **Impact:** About 5-12% more yield & 7-23% more net return over existing practice. The plant population @ 4.00 lakh /ha (25cm x 10cm) produced significantly 5% higher pod yield and higher net monetary return (Rs. 45186/ha) and application of 125% RDF to groundnut realized 22% more pod yield & Rs. 53492/ha over other treatments

Technology 9: Mulching, hydrogel and nutrient management for productivity of summer groundnut

- **Duration:** *rabi*/summer 2013-14 to 2015-16
- **Scientists involved:** Dr. HK Patro and Dr. SK Swain

- **Recommendation domain:** East & south-east coastal plain zone of Odisha
- **Existing practices:** Normal sowing without mulch and hydrogel with RDF (20:40:40)
- **Technology description:** Application of biodegradable mulch with soil application of hydrogel @ 2.5 kg/ha to groundnut with INM (50% organic + 50% inorganic) practices for higher yield & net returns from summer-groundnut
- **Impact:** Realized about 21% more yield and 45% more net return from mulching and 12 % more yield and 20 % more net return from with application of hydrogel., 8% more yield and 24% more net return from INM

Technology 10: DAPG-producing fluorescent pseudomonades for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of *kharif* groundnut

- **Duration:** *kharif* 2014 to 2016
- **Scientists involved:** Dr. HK Patro and Dr. SK Swain
- **Recommendation domain:** East & south-east coastal plain zone of Odisha.
- **Existing practices:** Seed treatment neither with *Trichoderma* spp nor with any PGPR before sowing of groundnut crop
- **Technology description:** Seed inoculation using DAPG producing fluorescent pseudomonades like FP 86, FP 98 and DAPG 4 produced higher yield and better nutrient use efficiency in *kharif* groundnut.
- **Impact:** About 18-28% more yield and less collar rot and dry root rot incidence over non-application

Technology 11: DAPG-producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of *rabi*-summer groundnut

- **Duration:** *rabi*/summer 2014-15 to 2016-17
- **Scientists involved:** Dr. SK Swain
- **Recommendation domain:** East & south-east coastal plain zone of Odisha
- **Existing practices:** Seed treatment neither with *Trichoderma* spp. nor with any PGPR before sowing of groundnut crop
- **Technology description:** Seed treatment with DAPG producing fluorescent pseudomonads like FP 86 and follow up application of FYM incubated FP 86 (4kg in 50 kg FYM) at 20-25 days after sowing of the crop for higher yield
- **Impact:** Pod yield increased (33%) due to application of FP 86 over control. Seed treatment and top dressing of FP 86 reduced collar rot (1.4) and dry root rot (1.8) incidence as compared to control

Technology 12: Integrated phosphorus management for higher productivity and profitability of *kharif* groundnut.

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. SK Swain
- **Recommendation domain:** East and south-east coastal plain zone of Odisha
- **Existing practices:** Application of P @ 40 kg/ha
- **Technology description:** Application of 5t FYM/ha along with 50% of recommended phosphorus (i.e. 20 kg/ha) to *kharif* groundnut +seed treatment with P-solubilising DGRC-1 culture for higher yield and better utilization of native soil phosphorus
- **Impact:** Seed treatment with DGRC-1 culture along with 50% P increased net return and BCR to Rs. 37310/ha and 1.76 from Rs. 34810/ha and 1.73, respectively over existing practice

AICRPG Center-Bikaner

Technology 1: DAPG-producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of groundnut

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. SP Singh and Dr. BDS Nathawat
- **Recommendation domain:** Hyper arid partially irrigated western plain zone of Rajasthan (I-C)
- **Existing practices:** Sowing seeds of groundnut without any inoculation with DAPG producing microbes, FP strains and *Trichoderma*
- **Technology description:** Seed treatments with *Trichoderma*, or DAPG producing fluorescent pseudomonads bring beneficial effect in terms of net return and B:C ratio
- **Impact:** A net profit of Rs. 2000 to 11000/ha can be obtained

Technology 2: Integrated phosphorus management for higher productivity and profitability of *kharif* groundnut

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. SP Singh and Dr. BDS Nathawat
- **Recommendation domain:** Hyper arid partially irrigated western plain zone of Rajasthan (I-C)
- **Existing practices:** No application of bio-fertilizer or microbial cultures
- **Technology description:** Application of 5 ton FYM with 40 kg P₂O₅/ha+seed treatment with DGRC-1 is recommended for the farmers of the zone
- **Impact:** Improves pod yield by 2.7 percent and net returns by Rs. 5000/ha on an average

AIPCRG Center-Dharwad

Technology 1: Skip row planting of groundnut under rainfed condition

- **Duration:** *kharif* 2005 to 2007
- **Scientists involved:** Dr. LH Malligawad and Dr. BS Yenagi
- **Recommendation domain:** Northern transitional zone VIII of Karnataka, rainfed groundnut under medium to deep black soils : Dharwad, Haveri, Gadag, Belgaum
- **Existing practice:** Groundnut sowing in 30 x 10 cm row spacing with plant population of 3, 33,333 plants per hectare on flat bed



Fig. 1: Skip row planting of groundnut under rainfed condition

- **Technology description:** For *in-situ* moisture conservation paired row planting in 2:1 skip row planting is recommended for higher productivity. Skip row planting involves skipping of one row after two rows of groundnut with intra row spacing of 7 cm resulting into skip row system of planting with plant population of 3, 33,333 plants per hectare and opening dead furrows with bullock drawn country plough at 25 to 30 days after sowing in skipped row (Fig. 1). This practice helps in *in-situ* rain water conservation and increases pod yield due to increase in number and weight of pods under normal rainfall situation. During moisture scared year, it gives better yield over normal planting due to balance between available soil moisture and plant population. In years of excess rainfall, dead furrow in skipped row will help in draining out excess water which otherwise affect crop performance
- **Impact:** Higher groundnut yields over normal planting during low rainfall years (21 to 37 %). Safe disposal of excess water during high rainfall years without causing soil erosion

Technology 2: Seed inoculation with plant growth promoting rhizobacteria (PGPR)

- **Duration:** *kharif* 2008 to 2010
- **Scientists involved:** Dr. LH Malligawad and Dr. BS Yenagi
- **Recommendation domain:** Northern transitional zone VIII of Karnataka, rainfed groundnut under medium to deep black soils : Dharwad, Haveri, Gadag, Belgaum
- **Existing practice:** Groundnut sowing without seed treatment with plant growth promoting rhizobacteria (PGPR).
- **Technology description:** Seed inoculation with plant growth promoting fluorescent pseudomonad's viz., PGPR 1, PGPR 2, and PGPR 4; and combination of PGPR 1, PGPR 2 and PGPR 4. Groundnut seeds to be inoculated with carrier based PGPR cultures using 5 per cent jaggary solution on the day of sowing. Seed inoculation with PGPRs improved the groundnut yield and yield components viz., number of pods plant⁻¹, dry pod weight plant⁻¹, shelling per cent, 100 kernel weight and percentage of sound mature kernels and also increased the nodule number and nodule dry weight plant⁻¹ (Fig. 2). Seed inoculation to be done on the day of sowing and inoculated seeds should be dried under shade only.



Fig. 2: Groundnut under rainfed condition with PGPR seed treatment

- **Impact:** Higher groundnut yields over normal planting to the extent of 10 to 16% over the years in addition to improvement in soil fertility

Technology 3: Soil application of ferrous sulphate @ 25.0 kg/ha

- **Duration:** *rabi*/summer 2005-06 to 2007-08
- **Scientists involved:** Dr. LH Malligawad and Dr. BS Yenagi
- **Recommendation domain:** Northern transitional zone VIII of Karnataka, rainfed groundnut under medium to deep black soils: Dharwad, Haveri, Gadag, Belgaum
- **Existing practice:** Application of major nutrients nitrogen, phosphorus and potassium in 25:75:25 kg per ha at the time of sowing (recommended). Generally farmers are using low rate of fertilizers as compared to recommended and unaware about application of micronutrient such as iron in groundnut crop. Deficiency of micronutrients in groundnut has been reported in groundnut grown in calcareous

soils and when such soils are subjected to irrigation water containing high bicarbonate and carbonates

- **Technology description:** Application of ferrous sulphate (Agriculture Grade) @ 25.0 kg/ha at the time of sowing or land preparation. It is also suggested to curing ferrous sulphate before its application along with organic manures such as FYM, compost, vermicompost; poultry manure etc. in order to enhance nutrient use efficiency. Application of ferrous sulphate enhances crop performance; checks iron deficiency particularly in iron deficient soils. It avoids interveinal chlorosis due to deficiency of iron (Fig. 3). It should not be applied along with major nutrient (nitrogen, phosphorus and potassium) supplying fertilizers such as urea, DAP, muriate of potash etc



Fig. 3: Typical iron deficiency (L) and crop with soil application of ferrous sulphate @ 25.0 kg/ha at farmers' field (R)

- **Impact:** Help to maintain yield potential and rectifies iron deficiency and improves the yield to the tune of 5 to 11%

Technology 4: Foliar application of water soluble foliar grade fertilizer in summer groundnut

- **Duration:** *rabi*/summer 2011-12 to 2013-14
- **Scientists involved:** Dr. LH Malligawad and Dr. BS Yenagi
- **Recommendation domain:** Northern transitional zone VIII of Karnataka, rainfed groundnut under medium to deep black soils : Dharwad, Haveri, Gadag, Belgaum
- **Existing practice:** Application of major nutrients nitrogen, phosphorus and potassium in 25:50-75:25 NPK kg per ha along with farm yard manure @ 7.5 t/ha at the time of sowing (recommended)
- **Technology description:** At reduced recommended basal dose of nitrogen (N), phosphorus (P_2O_5) and potassium (K_2O) fertilizers to groundnut (i.e., from 100 to 85 %), foliar application of starter dose of water soluble grade fertilizer (11:36:24 NPK kg per ha + Trace elements) 2% at 30 DAS) + foliar application of booster dose of water soluble grade fertilizer (8:16:39 NPK kg per ha + Trace elements) @ 2% at 45 DAS and 60 DAS was found beneficial in increasing pod yield of groundnut (Fig. 4)



Fig. 4: Application of recommended dose of nutrients (Left) and application of recommended dose of nutrients along with water soluble foliar grade fertilizer (Right)

- **Impact:** Higher groundnut yield (4.1%) and net returns (₹1712/ha) through integration of soil applied fertilizer and foliar application of nutrient

Technology 5: Nutrient management in groundnut + Bt-cotton intercropping system

- **Duration:** *kharif* 2010 to 2012
- **Scientists involved:** Dr. LH Malligawad and Dr. BS Yenagi
- **Recommendation domain:** Northern transitional zone VIII of Karnataka, rainfed groundnut under medium to deep black soils : Dharwad, Haveri, Gadag, Belgaum
- **Existing practices:** Application of 100% RDF to both the crops i.e., groundnut and Bt-cotton
- **Technology description:** Application of 75% RDF to groundnut and 100% RDF to Bt-cotton in groundnut+Bt-cotton (3:1) intercropping system
- **Impact:** Saves 25 % RDF to groundnut crop under intercropping system

Technology 6: DAPG-producing fluorescent pseudomonads for enhancing nutrient use efficiency, bio-control of soil-borne diseases and yield of groundnut

- **Duration:** *kharif* and *rabi* 2014 to 2016
- **Scientists involved:** Dr. BS Yenagi
- **Recommendation domain:** Northern transitional zone VIII of Karnataka, rainfed groundnut under medium to deep black soils: Dharwad, Haveri, Gadag, Belgaum
- **Existing practices:** Seed treatment with *Trichoderma* spp.
- **Technology description:** As a low-cost technology, seed treatment with any DAPG-producing fluorescent pseudomonads has beneficial effect on groundnut for enhancing nutrient use efficiency and bio-control of soil borne diseases. Groundnut seeds need to be treated with DAPG cultures using jaggery solution (6 to 10%). Jaggery solution to be prepared with 250 g of jaggery dissolved in 4 L of water. Recommended dose of DAPG @ 1 kg ha⁻¹ to be mixed in jaggery solution and slurry to be prepared. This slurry needs to

uniformly spread over the seeds of 1 ha and thoroughly mixed and dry under shade. The treated seeds should be used on the same day and if not next day, otherwise seeds will be infected with seed rotting fungal spores.

- **Impact:** Reduction in collar rot incidence by 51 to 73% and stem rot to the extent of 54 to 73% during *kharif* season and reduction in collar rot incidence by 24 to 53% and stem rot to the extent of 30 to 59% during *rabi*-summer season. Increase in yield to the tune of 11% and net returns to extent of Rs.11407 ha⁻¹

Technology 7: Integrated phosphorus management for higher productivity and profitability of *kharif* groundnut

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. BS Yenagi
- **Recommendation domain:** Northern Transitional Zone VIII of Karnataka, rainfed groundnut under medium to deep black soils : Dharwad, Haveri, Gadag, Belgaum



Fig. 5: Application of 50% recommended dose of phosphorus (37.5 kg ha⁻¹) + DGRC culture (Left) and recommended dose of phosphorus (Right)

- **Existing practices:** Application of 75 kg P₂O₅ kg ha⁻¹
- **Technology description:** Application of P bio-fertilizers such as DGRC-1 and DGRC-2 along with FYM @ 5 t ha⁻¹ and 50% RDP (75 kg P₂O₅ kg ha⁻¹) was found superior in terms of higher pod yield. Recommended dose of DGRC cultures @ 1 kg ha⁻¹ to be mixed in jaggery solution and slurry to be prepared. This slurry needs to uniformly spread over the seeds of 1 ha and thoroughly mixed and dry under shade (Fig. 5). The treated seeds should be used on the same day and if not next day, otherwise seeds will be infected with seed rotting fungal spores
- **Impact:** Saving on cost of phosphatic fertilizer to 50% without any reduction in yield

AICRPG Center-Durgapura

Technology 1: Land configuration and mulching for *kharif* groundnut

- **Duration:** *kharif* 2001 to 2003
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri. JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** Cultivation of groundnut was mostly on flat bed i.e. by conventional method . Sowing by tractor drawn seed drill or behind the plough is most common among the farmers of Rajasthan. The use of polythene or in-situ mulching is still not much common among farmers. This existing practice leads to hardening of soil surface and difficulty in peg penetration into the soil
- **Technology description:**

Land configuration: Broad bed furrow technique provides loose soil mass for development of pods. As groundnut pods grow underground, therefore the loose and well aerated seed bed is important as loose soil surface is useful for penetration of pegs and development of pods. The BBF was found superior in terms of moisture conservation and produced higher pod over conventional method

Mulching: Organic mulching was found to provide congenial conditions for growth and development of crop therefore produced significantly higher pod and haulm yield of groundnut over without mulching
- **Impact:** Improved pod yield and net returns

Technology 2: Zinc application in groundnut-wheat cropping system

- **Duration:** *kharif* 2001 to 2003
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri. JS Maheria



Fig. 6: Groundnut (L) and wheat (R) with zinc application

- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)

- **Existing practice:** Application of zinc to crops is lacking
- **Technology description:** Since micronutrients do have residual and cumulative effects, application of recommended doses of micronutrients to one crop will have some effect on the next grown in sequence. Zinc deficiencies are more common in calcareous and alkaline soils that are low in organic carbon. Application of full dose of zinc sulphate (30 kg/ha) to groundnut in first year and 50% dose (15 kg zinc sulphate) in following year to groundnut and no application of zinc in wheat crop is recommended (Fig. 6)
- **Impact:** Technology is very effective for higher production of groundnut-wheat cropping system

Technology 3: Optimization of plant density and fertilizer doses in groundnut+cluster bean intercropping

- **Duration :** *kharif* 2002 to 2004
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri. JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** In recent years, there has been an emphasis on working out the nutrient requirements on cropping system basis rather than based on individual crop but not much results and recommendations are available about their plant densities under inter-cropping
- **Technology description:** The associated crops are invariably of differential nature in growth and nutrient needs, thus the understanding of the system as a whole is important. The method of fertilizer application is important when component crops have different nutrient requirement in groundnut+cluster bean intercropping in 3:1 row ratio. Application of 100% and 50% RDF and maintenance of 75% and 100% plant density of groundnut and cluster bean, respectively is recommended for obtaining higher productivity and input use efficiency in groundnut +cluster bean intercropping system
- **Impact:** Technology is very effective for higher productivity and profitability in groundnut+clusterbean intercropping system

Technology 4: Organic manures, bio-fertilizers and bio-pesticide for confectionary groundnut

- **Duration:** *kharif* 2003 to 2005
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri. JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan).
- **Existing practice:** Organic farming of groundnut started very recently in Rajasthan when some exporters showed interest and approached progressive

farmers for production of confectionary type groundnut under organic systems. However, there is lacking of suitable organic production module for groundnut in Rajasthan.

- **Technology description:** Organic Manure (FYM, compost, vermicompost, oilcake, poultry manure etc.) have been found to have profound effect on improving soil physical, chemical and biological properties and enhancing productivity of field crops. In organic farming bio-fertilizers play an important role in sustaining crop productivity and maintaining soil health, particularly in semi and semiarid conditions. Bio-pesticides include biological agents (fungi and bacteria), and botanical pesticides. The bio-pesticides offer viable, cost effective and eco-friendly alternatives to synthetic pesticides for management of insect-pests and diseases of groundnut. In Rajasthan application of poultry manure @ 5 to 10 t/ha along with bio-pesticides (*Trichoderma*, *Neem* oil, *Neem* cake) and bio-fertilizers (*Rhizobium*+ PGPR+PSB) is recommended for cultivation of confectionary organic groundnut. Besides, foliar spray of *Pseudomonas* @ 1 % or NSKE @ 5 % or Panchagavya @ 3 % at 40 to 45 days after sowing is recommended
- **Impact:** Higher profitability to growers and improved soil health

Technology 5: Seed treatment for yield maximization in *kharif* groundnut

- **Duration:** *kharif* 2002 to 2004
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** Mostly farmers have seed treatment with fungicide/pesticides but quality of fungicide/pesticide is not satisfactory
- **Technology description:** Since the collar rot and stem rot diseases cause considerable plant mortality in early stages of crop growth, crop yield is directly affected by reduction in the plant stand. Treated seeds with Mancozeb @ 3 g/kg seed + soil application of *Trichoderma viride* @ 2.5 kg/ha (mixed with FYM) before sowing for reducing plant mortality and incidence of stem rot is recommended for zone III-a of Rajasthan
- **Impact:** Technology is very effective in controlling diseases in groundnut and becoming very popular among the groundnut growers

Technology 6: Field efficacy of PGPR's and their agri-formation on groundnut crop yield under semi-arid agro-ecosystem

- **Duration:** *kharif* 2007 to 2009
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** Few farmers follow seed treatment with *Rhizobium* culture but

quality of culture and viability is a big issue under climatically hot conditions of Rajasthan

- **Technology description:** Fluorescent pseudomonads have been found effective in producing siderophore and IAA in addition to characters like tri-calcium phosphate solubilization and *in-vitro* inhibition of *Aspergillus niger* and *Aspergillus flavus*. Seed inoculation with any of the PGPR isolates viz., PGPR1, PGPR 2 and PGPR 4 or in combination of the three is recommended
- **Impact:** Higher yield and net returns

Technology 7: Integrated weed management in *kharif* groundnut

- **Duration:** *kharif* 2008 to 2010
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri JS Maheria
- **Recommendation Domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** Yield of groundnut is reduced by 24 to 75% due to competition of weeds. Weed problems is very severe in the initial stages due to slow growth of crop. The critical period of weed competition was found to be from 28 to 42 days after sowing. The crop should be kept absolutely weed free up to 45 days after sowing. The weeds are preferred host of several insect –pests, and the vector of many important organisms causing diseases in groundnut. For controlling the weeds in groundnut, hand weeding is most popular method among the farmers which is very expensive, laborious and sometimes damaging to the plants



Fig. 7: Groundnut under weed free condition (L) and groundnut under weedy check plot ®

- **Technology description:** Herbicides, though, selective, efficient and cost effective in controlling weeds in groundnut, the maximum benefit can be achieved by combining herbicides with manual, cultural and mechanical weed control methods. These methods of weed control also vary with the groundnut growing situation and the cropping systems. Hence, pre-emergence application of pendimethalin @1.0 kg a.i. /ha + one hand weeding at 30 DAS proved practically more convenient and economically best feasible integrated weed management

practice for groundnut considering the present condition of scarcity and high cost of labours and also for higher yield and B:C ratio of cultivation of groundnut (Fig. 7). If hand weeding is not possible at 20 DAS due to unavailability of labour, pre-emergence application of pendimethalin @ 1.0 kg a.i./ha combined with post-emergence application of quizalafop- p-ethyl @ 50 g a.i./ha and imazethapyr 10 WC @ 50 g a.i./ha at 20 DAS along with one hand weeding at 45 DAS is recommended for effective weed control in groundnut

- **Impact:** 1. Effective weed control
2. Higher yield and net profit
3. Solution for labour unavailability

Technology 8: Growth hormones for *kharif* groundnut

- **Duration:** *kharif* 2008 to 2010
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri. JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** The farmers are not much aware about the use of growth hormones in groundnut crop
- **Technology description:** Two foliar applications of 100 ppm NAA at 30 and 45 DAS is recommended for higher pod yield of groundnut
- **Impact:** Higher yield and net returns

Technology 9: Management of sulphur and calcium through application of gypsum in irrigated confectionery groundnut

- **Duration:** *kharif* 2009 to 2011
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri. JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** Adequate amount of calcium is absolutely essential for getting high yield of good quality nuts. Calcium deficiency in groundnut results into unfilled pods (pops), darkening of the plumules and reduced pod development. Sulphur is directly involved in biosynthesis of oil. Sulphur is more deficient in soils, where groundnut is cultivated than any other nutrient. Groundnut has the unique characteristic of uptake of both calcium and sulphur by the developing pegs and pods. The critical limits of calcium and sulphur are 2 mg/100 g of soil and 100 ppm, respectively in the pod zone (0-15 cm depth of soil). If the soil test value indicates less than these limits, application of these nutrients becomes necessary. Gypsum is the cheapest source of calcium (24%) and sulphur (18.6%). For HPS groundnut popping problem is very serious. The farmers do not apply gypsum accordingly
- **Technology description:** The requirement of both calcium and sulphur can be met

through application of gypsum (Fig. 8). Well-powdered gypsum (30 mesh) should be applied to the crop, close to the base of the plant and availability of sufficient moisture is necessary at the time of application of gypsum for its efficient uptake. The basal application of 800 kg gypsum/ha is recommended for higher production of bold seeded (HPS) groundnut varieties



Fig. 8: Experts discussing importance of gypsum application in groundnut at farmers' field

- **Impact:** Higher yield of good quality nuts and better net returns

Technology 10: Nutrient management practice for yield maximization in groundnut

- **Duration:** *kharif* 2011 to 2013
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** The farmers are not much aware about the use of foliar application of urea to groundnut crop. Only recommended dose of fertilizers is applied as a basal dose of crop
- **Technology description:** Though groundnut is called as a self-fertilizing crop, it is very exhaustive compared to other legumes as very little portion of the plant is left in the soil after harvesting. Among the nutrients nitrogen, phosphorus, potassium, calcium and sulphur plays an important role in the nutrition of groundnut crop. Soil application of fertilizers lead to losses of nutrients in the form of leaching, volatilization and fixation affecting the nutrient use efficiency. For maximization

of crop yield application of FYM @ 7.5 t/ha + 100% NPK along with foliar application of urea @ 2 % at 30 and 60 DAS is recommended

- **Impact:** Higher pod yield and net returns

Technology 11: Drip irrigation in *kharif* groundnut for higher yield and nutrient use efficiency

- **Duration:** *kharif* 2010 to 2013
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar and Shri. JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** Water is a prime natural resource and important input for assured agriculture production. On an average, groundnut crop requires about 550-650 mm of water depending upon the soil types, season and groundnut cultivars. The productivity of groundnut under irrigated conditions is higher than that of under rain-fed condition. However, only 88% of the total area of groundnut is covered under irrigation in Rajasthan. There is not much scope for further area expansion under irrigated groundnut. In Rajasthan farmers are not using improved water management practices including proper scheduling of irrigation with good quality of irrigation water and not employing effective and economical irrigation methods
- **Technology description:** In drip method, only a part of soil in the vicinity of plant roots is wetted and kept close to field capacity. This method though costly, has its own justification as increased yield, high irrigation efficiency, and wide adaptability. For drip irrigation in groundnut, drip laterals (having drippers at 30 cm distance and 1.75-2.0 kg/cm² pressure and 4 liter/hour discharge rate) should be installed at the interval of three rows (row spacing 30 cm) or keep 90 cm distance between two laterals which should be operated for 50 minutes in the month of June and 30 minutes during rest of the crop period (July to October) on alternate days. This system saves about 60% water and gives higher yield in comparison to surface irrigation systems
- **Impact:** Technology is recently developed and just spreading among the farmers. The impact analysis of the technology is to be assessed due course of time

Technology 12: Optimum irrigation levels and hydrogel levels for higher productivity of *kharif* groundnut

- **Duration:** *kharif* 2011 to 2013
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar, Dr. KC Gupta, Dr. Rani Saxena and Shri. JS Maheria
- **Recommendation domain:** Semi-arid eastern plain zone-IIIa of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practice:** The productivity of groundnut under irrigated condition is higher than that of under rain fed condition. However, only 88% of the total area of

groundnut is cover under irrigated in the Rajasthan. There is not much scope to further expand area under irrigation in groundnut. Therefore, the available water for irrigation has to be used judiciously by adopting improved water management practices and with the help of application of hydrogel in groundnut

- **Technology description:** Hydrogel can absorb irrigation and rainwater and help to reduce deep percolation. Water requirement can be reduced with the application of “Pusa hydrogel” which is an indigenous semi-synthetic super absorbent technology for enhanced soil moisture availability in root zone and higher crop productivity and thereby increasing the water use efficiency. Application of hydrogel @ 3.5kg/ha with irrigation water at 0.8 IW/CPE is recommended
- **Impact:** Higher yield and profitability, higher water use efficiency and reduced impact of drought on crop plants

Technology 13: DAPG-producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of *kharif* groundnut

- **Duration:** *kharif* 2014 to 2016
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar
- **Recommendation domain:** Semi arid eastern plain zone of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practices:** Farmer follow seed treatment with *Rhizobium* culture, fungicides and insecticides
- **Technology description:** Besides *Trichoderma* spp. use of any DAPG producing fluorescent pseudomonads as seed treatment was found equally effective for enhancing groundnut pod yield
- **Impact:** Pod yield increased by 8.5% to 15.7% over non-use of bio-inoculants

Technology14: Integrated phosphorus management for higher productivity and profitability of *kharif* groundnut

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. Yogendra Kumar Sinsinwar
- **Recommendation domain:** Semi-arid eastern plain zone of Rajasthan (Jaipur, Ajmer Dausa and Tonk districts of Rajasthan)
- **Existing practices:** Application of 60 kg P₂O₅ per ha
- **Technology description:** Application of FYM @ 5.0 t/ha + 50 % P (30 kg/ha) with DGRC-1 was found significantly superior in terms of pod yield of groundnut
- **Impact:** Pod yield increased by 31 percent over control and 10.7 percent over application of FYM @ 5.0 t/ha + 50 % P

AICRPG center- Gwalior

Technology 1: Response of *kharif* groundnut to plant geometry and fertility levels

- **Duration:** *kharif* 2015 to 2018
- **Scientists involved:** Dr. Ekta Joshi
- **Recommendation domain:** Gird region of Madhya Pradesh (Zone VIII)
- **Existing practices:** Sowing at 30x10 cm spacing (3.33 lakh plants/ha) with 20:60:20 kg/ha of NPK (100 percent RDF)
- **Technology description:** Sowing at 30x10cm spacing (3.33 lakh plants/ha) with application of 25:75:25 kg/ha of NPK (125 percent RDF)
- **Impact:** Sowing Mallika (ICHG-00440) at 30x10 cm spacing with application of 125 percent NPK increased pod yield, harvest Index, net returns and BC ratio by 4.4, 8.3, 5.2 and 2.6 percent, respectively

Technology 2: Application of bio-formulations in *kharif* groundnut production.

- **Duration:** *kharif* 2017 to 2019
- **Scientists involved:** Dr. Ekta Joshi
- **Recommendation domain:** Gird region of Madhya Pradesh (Zone VIII)
- **Existing practices:** Farmers apply no bio-fertilizers and only 20:60:20 kg/ha of NPK is applied
- **Technology description:** Application of 75% RDF along with NPK liquid formulation + Zn solubilising bacteria bio formulations
- **Impact:** Application of 75% RDF along with NPK liquid formulation + Zn solubilizing bacteria in groundnut crop variety “JGN 3” resulted in the higher pod yield, HI, B:C, gross and net returns as well as higher soil available N, P, K and organic carbon content in groundnut crop

AICRPG center- Jagtial

Technology 1: Bio-Fertilizers for high productivity of groundnut under Rice fallows

- **Duration:** *rabi*/summer 2006 to 2009
- **Scientists involved:** Dr. V Venkanna and Dr. M Venkataiah
- **Recommendation Domain:** Northern Telangana zone of Telangana state
- **Existing practice:** Indiscriminate use of inorganic sources of nutrients by the farmers thereby contributing to decline in productivity and soil fertility. Majority of the growers do not use biofertilizers
- **Technology description:** Build-up of microorganisms in the soil is very important. INM practices involving bio-fertilizers help achieve sustainability of production and maintain soil fertility. Inoculation with *Rhizobium* culture is very much recommended under rice fallows for newly groundnut cultivated soils for realizing higher yields. Sowing groundnut following rice, after seed treatment with *Rhizobium* (IGR-6 and NRCG-9 strains) gives good yield as it increases nodule number and nodule dry weight per plant
- **Impact:** Gives higher yield and net returns

Technology 2: Post-emergence herbicides for weed control in groundnut

- **Duration :** *kharif* and *rabi* 2007 to 2010
- **Scientists involved:** Shri. T Krishna Mohan and Dr. Sreedhar Chauhan
- **Recommendation domain:** Northern Telangana zone of Telangana State
- **Existing practice:** In general farmers perform two manual weeding in groundnut at 20 and 40 DAS. Usage of pre and post emergence herbicides is not adopted by majority of the farmers in this region. Only some of the farmers apply Alachlor, pendimethalin and butachlor



Fig. 9: Groundnut under weed free condition (L) and groundnut under weedy check plot (R)

- **Technology description:** Pre-emergence application of pendimethalin @ 1.0 kg a.i./ha+one hand weeding at 25-30 DAS proved practically more convenient and economically best feasible integrated weed management practice for groundnut considering the present condition of scarcity and high cost of labours, quality of weed control, yield and B:C ratio of cultivation of groundnut. If hand weeding is not possible, pre-emergence application of pendimethalin @ 1 kg a.i./ha combined with post emergence application of either quizalofop-ethyl @ 50 g a.i./ha or imazethapyr @ 75 g a.i./ha could be alternative method of weed control in *kharif* groundnut (Fig. 9). During *rabi* groundnut maximum pod yield was obtained with application of combination of Pre- and post-emergent herbicides i.e. pendimethalin (30% EC) @1.0 kg a.i./ha and Quizalofop-ethyl (5 EC) 50g a.i./ha at 20 DAS or application of pendimethalin (30% EC) @ 1.0 kg a.i./ha + imazethapyr @ 75g a.i./ha at 20 DAS
- **Impact:** 1. Gives higher yield and net returns
2. Help overcome scarcity of labour and high labour cost

Technology 3: Nutrient management practices for yield maximization in *kharif* groundnut

- **Duration :** *kharif* 2011 to 2013
- **Scientists involved:** Dr. Sreedhar Chauhan, Dr. M Venkataiah and Dr. T Thirumal Rao
- **Recommendation domain:** Northern Telangana zone of Telangana State
- **Existing practice:** Groundnut crop is mostly cultivated in low input management conditions during *kharif* under rainfed conditions. Farmers generally apply low quantity of fertilizers (complex fertilizers like DAP) for rainfed groundnut, and do not apply gypsum (non-availability) due to which yield is drastically reducing year by year. In order to maximize the yield of rainfed groundnut nutrient management is must
- **Technology description:** The optimization of the mineral nutrition have a key role in production maximization of groundnut. Application of recommended dose of nitrogen, phosphorus and potassium along with FYM @ 7.5 t/ha along with soil application of critical micro nutrients i.e. Fe, Zn and B was found to give significantly higher pod yield of groundnut compared to application of recommended dose of NPK alone
- **Impact:** 1. Gives higher yield and net returns
2. Improves quality of kernels
3. Maintains soil fertility

Technology 4: Nutrient management practices for production maximization in *rabi/summer* groundnut

- **Duration :** *rabi/summer* 2009- 2012
- **Scientists involved:** Dr. P Revathi, Dr. Sreedhar Chauhan, Dr. M Venkataiah and Dr. V Thirumala Rao

- **Recommendation domain:** Northern Telangana zone of Telangana State
- **Existing practice:** Majority of the farmers in general apply fertilizers and manures as basal only and split application is not a common practice
- **Technology description:** Among the nutrient management practices application of 7.5 t/ha FYM and 50% RDF as basal and remaining half of the recommended fertilizer as top dressing at 30 DAS produced maximum yield than basal application of whole of fertilizers and manure. Application of half of the RDF as top dressing significantly contributes to groundnut productivity
- **Impact:** 1. Higher yield and net returns
2. Improves nutrient use efficiency

Technology 5: Water soluble foliar grade fertilizers for higher growth and yield of groundnut during *rabi*/summer

- **Duration :** *rabi*/summer 2011-2013
- **Scientists involved:** Dr. P Revathi, Dr. M Venkataiah and Dr. P Goniya Nayak
- **Recommendation domain:** Northern Telangana zone of Telangana State
- **Existing practice:** Majority of the farmers don't know to apply water soluble fertilizers and every time they apply DAP and MOP
- **Technology description:** Application of 100% RDF, FYM @ 7.5 t/ha and foliar application of water soluble grade fertilizers @ 2% (starter dose and booster dose) gives high yields than application of 100% RDF + FYM @ 7.5 t/ha
- **Impact:** Higher yield and net returns

Technology 6: Mulching, hydrogel and nutrient management in summer groundnut

- **Duration :** *rabi*/summer, 2011-2012 to 2013-2014
- **Scientists involved:** Dr. P Revathi, Dr. M Venkataiah and Dr. P Goniya Nayak
- **Recommendation domain:** Northern Telangana zone of Telangana State
- **Existing practice:** Farmers apply irrigations at very close interval to the groundnut crop and are not aware about hydrogel technology in the region
- **Technology description:** Application of 5 kg hydrogel ha⁻¹ along with plastic mulch and INM practices obtained high yields. Water saving of 20 % was noticed with the application of hydrogel
- **Impact:** 1. Higher yield and net returns
2. Higher water use efficiency

Technology 7: Nutrient management practices for yield maximization in *rabi*/summer groundnut

- **Duration:** *rabi*/summer 2011-12 to 2013-14
- **Scientists involved:** Dr. P Revathi, Dr. M Venkataiah and Dr. P Goniya Nayak

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- **Recommendation domain:** Northern Telanagana zone of Telanagana state
 - **Existing practices:** Farmers apply whole of recommended dose of fertilizers through basal application
 - **Technology description:** Application of 75% RDF as basal and 75% RDF as top dressing at 30 days after sowing
 - **Impact:** Higher yield and net returns.

Technology 8: Fertilizer doses and optimum plant population for *rabi*/summer groundnut under drip irrigation

- **Duration:** *rabi*/summer 2014-15 to 2016-17
- **Scientists involved:** Dr. P Revathi, Dr. M Venkataiah and Dr. P Goniya Nayak
- **Recommendation domain:** Northern Telanagana zone of Telanagana state
- **Existing practices:** Flood irrigation and basal application of DAP fertilizers with a spacing of 30 x 10 cm
- **Technology description:** Drip irrigation increased pod yield and net returns by 77.1 and 78.0 percent, respectively over check basin method of irrigation. Plant population of 4.0 lakh plants per ha⁻¹ at 25 x 10 cm is recommended for higher pod yield 75% with 74% net returns. Application of 75% RDF under drip irrigation was found to give yield at par with 100% RDF (30:40:40 N:P:K kg ha⁻¹)
- **Impact:** 1. Higher yield and net returns
2. Higher water and nutrient use efficiency

AICRPG center-Jalgaon

Technology 1: Nutrient management practices for production maximization of summer groundnut

- **Duration:** summer 2010 to 2012
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil and Mr. BD Malunjakar
- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practices:** Application of 100 % RDF (25:50:00) at the time of sowing
- **Technology description:** Application of 150% of RDF (25:50:00) as basal+ FYM @ 7.5 t ha⁻¹ is recommended for higher yield and net returns of summer groundnut
- **Impact:** Higher yield and net returns

Technology 2: Management of sulphur and calcium through application of gypsum in rainfed groundnut

- **Duration:** *kharif* 2009 to 2011
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil and Mr. BD Malunjakar
- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practice:** Application of gypsum @ 250 kg/ha split as 50 % (125 kg/ha) at the time of sowing and 50 % (125 kg/ha) at 45 DAS
- **Technology description:** Application of gypsum @ 400 kg ha⁻¹ split as 50% (200kg/ha) at the time of sowing and remaining 50 % (200 kg/ha) at 45 DAS
- **Impact:** Higher yield and net returns

Technology 3: Scheduling of irrigation in groundnut during *rabi* / summer

- **Duration:** summer 2011 to 2013
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil and Mr. BD Malunjakar
- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practices:** Scheduling irrigation at 8-10 days interval during summer season by surface/ flood method of irrigation
- **Technology description:** Scheduling irrigation through drip irrigation at 80% evapotranspiration rate on alternate days with 60 cm lateral spacing is recommended for higher yield, net returns and water use efficiency
- **Impact:** 1. Higher yield and net returns
2. Higher water use efficiency

Technology 4: Nutrient management practices for yield maximization in *kharif* groundnut

- **Duration:** *kharif* 2011 to 2013
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil and Mr. BD Malunjakar

- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practices:** Application of RDF (25:50:00 kg NPK/ha) at the time of sowing without use of micronutrient and foliar spray
- **Technology description:** Application of FYM @ 7.5 t ha⁻¹ + RDF (25: 50:00 kg NPK/ha) along with soil application of FeSO₄ and ZnSO₄ @ 20 kg/ha and foliar application of urea @ 2% at 30 and 60 DAS is recommended for higher yield and net returns
- **Impact:** 1. Higher yield and net returns
2. Maintain soil fertility

Technology 5: Irrigation management and hydrogel in *kharif* groundnut

- **Duration:** *kharif* 2011 to 2013
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil and Mr. BD Malunjakar
- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practices:** Scheduling irrigation water during dry spell and according to the crop need by surface/ flood irrigation
- **Technology description:** Application of irrigation water at 0.8 IW/CPE and hydrogel @ 2.5 kg/ha is recommended
- **Impact:** 1. Higher yield and net returns
2. Higher water use efficiency

Technology 6: Nutrient management in prevalent groundnut-based cropping system

- **Duration:** *kharif* 2013 to 2015
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil and Mr. BD Malunjakar
- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra.
- **Existing practices:** Application of 100% RDF (25:50:00 kg NPK/ha) to groundnut crop during *kharif* season and 100% RDF (120:60:40 kg NPK/ha) to wheat crop during rabi season
- **Technology description:** The maximum yield and economics from groundnut followed by wheat crop sequence is realized with application of 25 kg N and 75 kg P to *kharif* groundnut and 75% RDF to *rabi* wheat. It gives higher yield (15.5 %) and net realization (Rs. 15672/ha) from *kharif* groundnut. Also saves 25% RDF in subsequent wheat crop without compromising the yield significantly
- **Impact:** 1. Higher yield and net returns.
2. Brings down cost of production

Technology 7: Fertilizer doses and plant population under drip fertigation for *rabi*/summer groundnut

- **Duration:** *rabi*/summer 2013-14 to 2015-16
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil, Mr. DB Patil and Mrs. SB Patil

- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practices:** Groundnut sowing on flat beds at 30 x 10 cm spacing (3.33 lakh plants/ha) with 100% RDF (25:50:00 kg NPK/ha) as basal application at sowing using flood irrigation system
- **Technology description:** Groundnut sowing at plant spacing at 25 x 10cm (4.00 lakh plants/ha) with 100% RDF (25:50:00 kg NPK/ha) as fertigation using drip irrigation at alternate day with 9 equal splits along with basal application of 5t/ha FYM is recommended
- **Impact:**
 1. About 30% water saving and 25% higher nutrient use efficiency with 17-46% higher pod yield over conventional sowing of groundnut at spacing 30 x 10 cm with 100 % RDF (25:50:00 kg NPK/ha)
 2. Higher net return and BCR

Technology 8: Mulching, hydrogel and nutrient management for higher productivity of summer groundnut

- **Duration:** *rabi*/summer 2013-14 to 2015-16
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil, Mr. DB Patil and Mrs. SB Patil
- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practices:** Sowing on flat beds (30 x 10 cm spacing) using RDF (25:50:00) without mulch and hydrogel
- **Technology description:** Sowing of groundnut on raised bed of 90 cm with mulch, application of hydrogel @ 2.5 kg/ha and integrated nutrient management through application of 50 % RDF through organic sources (FYM) and 50 % of RDF through chemical fertilizers (Urea and SSP) is recommended
- **Impact:**
 1. Mulching gives about 34% more yield and 86% more net return
 2. Hydrogel gives 7% more yield and 17% more net return besides 33% water saving

Technology 9: DAPG-producing fluorescent pseudomonades for enhancing nutrient use efficiency, bio-control of soil-borne diseases and higher yield of *kharif* groundnut

- **Duration:** *kharif* 2014 to 2016
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil, Mr. DB Patil and Mrs. SB Patil
- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practices:** Seed treatment is not followed by farmers at the time of groundnut sowing
- **Technology description:** Application of DAPG-4 bio inoculants as seed treatment is recommended for higher *kharif* groundnut yield, economic return and control of soil borne disease incidence of stem rot and collar rot

- **Impact:** 1. About 47% higher pod yield with higher net returns and BCR over existing practice
2. Reduces diseases incidence for stem rot (44%) and collar rot (58%)

Technology 10: DAPG- producing fluorescent pseudomonades for enhancing nutrient uses efficiency, bio-control of soil-borne diseases and higher yield of rabi/summer groundnut

- **Duration:** summer 2014-15 to 2016-17
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil, Mr. DB Patil and Mrs. SB Patil
- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practices:** Seed treatment is not followed by farmers at the time of groundnut sowing
- **Technology description:** Application of FP-98/ FP-86 bio inoculants as seed treatment is recommended for increased summer groundnut yield
- **Impact:** 1. About 61% higher pod yield with higher net returns and BCR over existing practice.
2. Reduces diseases incidence for stem rot (40%) and collar rot (52%)

Technology 11: Integrated phosphorus management for higher productivity and profitability of kharif groundnut

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. BB Mulik, Dr. SC Patil, Mr. DB Patil and Mrs. SB Patil
- **Recommendation domain:** Plateau and assured rainfall zone of Maharashtra
- **Existing practices:** Seed treatment with P solubilizers is not followed by farmers at the time of groundnut sowing and application of recommended dose of phosphorus 50 kg/ha is practiced
- **Technology description:** Application of 5 t FYM /ha + 50 % P + DGRC 2 as seed treatment is recommended to improve *kharif* groundnut yield, and net returns
- **Impact:** 1. About 66% higher pod yield with net returns and BCR over existing practice
2. Reduces cost on phosphorus fertilizers by 50 percent

AICRPG center-Junagadh

Technology 1: Optimum plant density and fertilization for groundnut pigeon pea relay cropping system

- **Duration:** *kharif* 2008 to 2010
- **Scientists involved:** Dr. KV Jadav, Dr. PM Vaghasia and Dr. VB Bhalu
- **Recommendation domain:** South Saurashtra agro climatic zone (AESR-5)
- **Existing practice:** Yield depends on several agronomic factors. Among them, maintenance of optimum plant population and application of required amount of fertilizers play vital role in getting higher yield of crop. Generally, farmers do not maintain optimum plant density and follow blanket application of fertilizers, mostly DAP, instead of applying RDF
- **Technology description:** Among the different agronomical practices in the groundnut pigeon pea relay cropping system, fertilizer management and plant population of the main and relay crop is the most important factor influencing the total productivity of the system. Hence, application of 100% RDF (12.5-25.0 kg NP/ha) and 100% plant density (1.66 lakh/ha) of groundnut and, 50% RDF (12.5-25.0 kg NP/ha) and 100% plant density (0.28 lakh/ha) of pigeonpea is recommended for groundnut + pigeonpea relay cropping system for higher yield and net return of system (Fig. 10)



Fig. 10: Groundnut+Pigeonpea intercropping in 2:1 ratio (L) and sole groundnut at 60 x 10 cm spacing ®

- **Impact:** 1. Higher net return under erratic and uneven rainfall distribution of South Saurashtra Agro-climatic zone of Gujarat state
2. 65 % increased net return

Technology 2: Use of post-emergence herbicides in *kharif* groundnut

- **Duration:** *kharif* 2006 to 2009
- **Scientists involved:** Dr. KV Jadav, Dr. PM Vaghasia and Dr. VB Bhalu
- **Recommendation domain:** South Saurashtra agro climatic zone. (AESR-5)

- **Existing practice:** Groundnut yield depends on several agronomic factors. Weed management plays an important role in groundnut production. Farmers generally spray pre-emergence herbicides; however, 20 to 25 days after germination of groundnut weeds again pose challenge adversely affecting the growth and yield of groundnut. The problem can be further aggravated by unpredictable weather conditions. The continuous and frequent rainfall cannot permit to enter in the field for hand weeding or inter culturing operation. Yield losses of groundnut due to weeds ranges from 24-70 per cent. For controlling weeds in groundnut, mechanical interculturing and hand weeding is most popular method among the farmers which is very expensive, laborious and sometimes damaging to the crop plants
- **Technology description:** Groundnut is a major oilseed crop grown in *kharif* season under rainfed condition. Alternate effective and economical weed control measures through application of post-emergence herbicide along with pre-emergence herbicide spray can manage the weed population effectively. The farmers of South Saurashtra Agro-climatic region growing groundnut in *kharif* season are advised to keep crop weed free by 3 hand weddings and interculturing at 20, 40 and 60 DAS. Under paucity of farm labour, they are advised to apply pendimethalin 30 EC @ 1.0 kg a.i./ha as pre-emergence and quizalofop ethyl 5 EC @ 50 g a.i. /ha or imazethapyr @ 75 g a.i. /ha as post emergence at 20 DAS for effective weed control and net return (Fig. 11)



Fig. 11: Groundnut crop treated with pendimethalin 30 EC (L), Pendimethalin 30 EC+ quizalofop ethyl 5 EC (C) and Control (R)

- **Impact:** Technology is developed and spreading among the farmers. The combination with pre-emergence and post emergence herbicide spray can manage the weed population effectively under adverse weather condition and at paucity of labour. The yield of groundnut and net return are increased

Technology 3: Maintenance of optimum plant density of groundnut under rainfed condition

- **Duration:** *kharif* 2010 to 2012
- **Scientists involved:** Dr. KV Jadav, Dr. PM Vaghasia and Dr. VB Bhalu
- **Recommendation domain:** South Saurashtra agro climatic zone(AESR-5)
- **Existing practice:** Generally farmers don't treat the seed with fungicide even though plant population of the groundnut is decreased significantly due to stem rot and collar rot infections

- **Technology description:** The optimum plant population play vital role in yield of groundnut. Plant density is maintained by using recommended seed rate and also by giving suitable and effective seed treatments. The rain fed groundnut (cv. GG-20) is recommended to sow with bullock drawn automatic seed drill keeping 120 kg seed rate ha⁻¹ and seeds should be treated with Mancozeb @ 3.0 g/kg seed + soil application of FYM based *Trichoderma viride* @ 2.5 kg/ha at the time of sowing for reducing plant mortality and incidence of stem rot
- **Impact:** Significantly decrease stem and collar rot incidence and increase groundnut yield

Technology 4: Nutrient management practices for yield maximization in groundnut

- **Duration:** summer 2009-10 to 2011-12
- **Scientists involved:** Dr. PM Vaghasia, Dr. VB Bhalu and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra agro climatic zone (AESR-5)
- **Existing practice:** Farmers mostly use only chemical fertilizers. Most of the farmers use comparatively higher rate of fertilizers as compared to recommended dose of fertilizers i.e. 25:50:00 NPK kg ha⁻¹ and whole quantity of fertilizers is applied at the time of sowing of crop
- **Technology description:** The mineral nutrition plays key role in production maximization of groundnut. Hence, application of 100% RDF (25:50:00 NPK kg ha⁻¹) as basal dose + 50% RDF (12.5:25:00 NPK kg ha⁻¹) as top dressing at 30 DAS is recommended for not only higher pod, kernel and haulm yield but also higher net returns over 100% RDF as basal (Fig. 12)



Fig.12: Crop with 100% RDF as basal dose + 50% RDF as top dressing at 30 DAS (L) and 100% RDF as basal dose (R)

- **Impact:** Split application of fertilizer at higher rate (150% RDF) with FYM @ 7.5 t/ha was found beneficial in increasing the pod yield of groundnut and give higher net returns

Technology 5: Management of sulphur through application of gypsum in rainfed groundnut

- **Duration:** *kharif* 2009 to 2011

- **Scientists involved:** Dr. KV Jadav, Dr. PM Vaghasia and Dr. VB Bhalu
- **Recommendation domain:** South Saurashtra agro climatic zone(AESR-5)
- **Existing practice:** Farmers are generally using only NPK. They are not applying any other plant nutrients
- **Technology description:** Application of gypsum @ 400 kg/ha as basal application is recommended for significantly higher pod, kernel and oil yield (Fig. 13)



Fig. 13: Crop with application of gypsum @ 400 kg/ha (L) and control (R)

- **Impact:** Increased the pod, kernel and oil yield

Technology 6: Organic and bio-fertilizers and bio-pesticides for organic groundnut production during *kharif*

- **Duration:** *kharif* 2002 -200
- **Scientists involved:** Dr. KV Jadav, Dr. PM Vaghasia and Dr. VB Bhalu
- **Recommendation domain:** South Saurashtra agro climatic zone (AESR-5)
- **Existing practice:** Farmers use synthetic chemical fertilizers and pesticides in groundnut production
- **Technology description:** Different organic fertilizers and bio-pesticides have significant effect on pod, haulm, kernel and oil yield, shelling percent, seed weight and oil content in groundnut. Application of FYM @10 t/ha + bio pesticides (castor cake 500kg/ha + *Tricoderma* seed treatment 5 g/kg seed + spray of neem seed kernel extract 2%) is recommended for higher yield and net returns from organically grown groundnut
- **Impact:** Application of organic, bio-fertilizers and bio-pesticides increases pod, kernel and haulm yield

Technology 7: Nutrient management and plant protection for organic groundnut production during summer

- **Duration:** summer 2006-07 to 2008-09
- **Scientists involved:** Dr. KV Jadav, Dr. PM Vaghasia and Dr. VB Bhalu
- **Recommendation domain:** South Saurashtra Agro climatic Zone (AESR-5)

- **Existing practice:** Farmers use only synthetic chemical fertilizers and pesticides
- **Technology description:** For organic groundnut production during summer, application FYM @ 7.5 t/ha + seed treatment with bio-fertilizers (*Rizobium* + PSM + PGPR) and bio-pesticides (Castor cake 500kg/ha + *Tricoderma* seed treatment 5g/kg seed + spray of neem seed kernel extract 2%) is recommended. In addition, foliar spray of either *Pseudomonas* @ 1% or NSKE @ 5% or *panchagavya* @ 3% at 40 to 45 days after sowing is also recommended
- **Impact:** Application of organic manure, bio-fertilizers and bio-pesticides gave higher pod, kernel and haulm yield

Technology 8: Drip irrigation system in summer groundnut

- **Duration:** summer 2010 to 2012
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra agro climatic zone. (Zone VII)
- **Existing practice:** Farmers of South Saurashtra Agro climatic zone generally apply flood irrigation in groundnut resulting in more wastage of water, and more insect-pest incidence and more labour requirement
- **Technology description:** Groundnut is an important oilseeds crop grown in the *kharif* and summer season. Water is the most vital resource in crop production under summer season, especially in arid and semi arid regions. Drip irrigation system provides optimum quantity of water to the crop for maximum yield and simultaneously saving of valuable water from wastage and increasing the water use efficiency. The soil wetting patterns under different crop geometry are controlled by irrigation levels. Groundnut irrigated through drip irrigation at 100 cent percent average daily pan evaporation at alternate day and sowing the crop at 30 cm spacing with one lateral to each row resulted in maximum pod yield and net realization during summer. The system details are:
 1. Lateral spacing = 30 cm
 2. Dripper spacing = 45 cm
 3. Dripper discharge = 2 lph
 4. Operating time = 1 hour and 5 minutes at alternate day
 5. Operating pressure = 1.2 kg/cm²
- **Impact:**
 1. Higher yield and net returns.
 2. Higher water use efficiency and water saving

Technology 9: Nutrient management in groundnut- Bt. cotton intercropping system

- **Duration:** *kharif* 2012 to 2014
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra Agro climatic zone (Zone VII)
- **Existing practice:** In Saurashtra region, groundnut-cotton intercropping is

popularizing among the farmers due to higher yield potentiality and to some extent drought resilience capacity. Groundnut is grown under rainfed conditions in Saurashtra and also a suitable crop for intercropping with cotton. Yield varies widely from field to field and season to season. Numbers of factors are responsible for crop yield, but fertilizer management is one of the most vital factors for crop production. Farmers are not scheduling appropriately nutrient management in intercropping system

- **Technology description:** The farmers of South Saurashtra Agro-climatic Zone adopting groundnut- B.t. cotton inter-cropping system (in 3:1 ratio) are advised to apply 100% recommended dose of fertilizers (12.5-25.0-00.0 NPK kg/ha) to the groundnut crop and 100% recommended dose of fertilizer to the cotton crop (240:50:150 NPK kg/ha) for obtaining higher yield and net realization
- **Impact:** Improved productivity, nutrient use efficiency and monetary advantage

Technology 10: Water soluble foliar grade fertilizers for summer groundnut

- **Duration:** summer 2011-12 to 2013-14
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra Agro climatic zone. (AESR-5)
- **Existing practice:** Farmers generally apply higher dose of fertilizers as basal in soil. The farmers are not much aware about the use of water soluble foliar grade fertilizers to groundnut crop
- **Technology description:** Foliar feeding is most effective and economical way to correct plant nutrient deficiencies. Foliar feeding of a nutrient may also promote root absorption of the same nutrient or other nutrients through improving root growth and increasing nutrients uptake. The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut are advised to fertilize the crop with FYM @ 7.5 t/ha + 100% RDF(25-50 kg N-P₂O₅/ha) along with foliar application of water soluble grade fertilizer @ 2% starter dose (11:36:24 % NPK + Borax 2%) at 30 DAS and booster dose (8:16:39 % NPK + Borax 2%) at 45 and 60 DAS for obtaining higher yield and net realization
- **Impact:**
 1. Increased yield and improved quality of groundnut.
 2. Higher nutrient use efficiency and nutrient recovery and lowers environmental pollution.

Technology 11: Optimum irrigation levels and hydrogel for higher productivity of *kharif* groundnut

- **Duration:** *kharif* 2013 to 2015
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra agro climatic zone of Gujarat (AESR-5)
- **Existing practice:** Flood irrigation is applied to groundnut by farmers and not much aware about the use of hydrogel in groundnut crop

- **Technology description:** Optimum irrigation levels and application of hydrogel maintains optimum soil moisture for maximum yield and simultaneously saving of valuable water and increasing the water use efficiency. Significantly higher pod yield (3329 kg/ha), kernel yield (2454 kg/ha) and oil yield (1285 kg/ha) were recorded by application of hydrogel @ 3.5 kg/ha with irrigation water at 0.8 IW/CPE, which was remained at par with application of hydrogel @ 2.5 kg/ha. Gross return and net return were also found higher at same treatment. Application of hydrogel @ 3.5 kg/ha with irrigation water at 0.8 IW/CPE was recommended for higher yield
- **Impact:** 1. Higher yield and net returns
2. Water saving and higher WUE

Technology 12: Resource optimization for higher monetary benefits in *kharif* groundnut

- **Duration:** *kharif* 2011 to 2013
- **Scientists involved:** Dr. PM Vaghasia, Dr. KL Dobariya and Prof. KD Vekaria
- **Recommendation domain:** South Saurashtra agro climatic zone(AESR-5)
- **Existing practice:** Farmers partially adopt recommended groundnut production technology. They do not apply full recommended package of practices in groundnut cultivation
- **Technology description:** Adoption of full package of practices recorded significantly higher pod, haulm kernel and oil yield than rest of the treatments. Integrated Crop Management (ICM) module consisting of weed management, recommended dose of fertilizers and plant protection measures, was found most effective in harnessing good yield and net returns. The withhold of fertilizer, plant protection, and weeding operations resulted in yield reduction to the tune of 13.5, 21.5, and 45.4 %, respectively. The withhold of fertilizer + plant protection, fertilizer + weeding operation, and weeding + plant protection resulted to 35.3, 58.8 and 51.3 percent reduction in yield. When fertilizer + plant protection + weeding operations are carried out as per recommended practices yield increased to the tune of 60.2 % over farmers' practice
- **Impact:** Higher yield, net returns and input use efficiency

Technology 13: Nutrient management practices for yield maximization in *kharif* groundnut

- **Duration:** *kharif* 2011 to 2013
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra agro climatic zone (AESR-5)
- **Existing practice:** Farmers are applying only major plant nutrients (NPK) as basal application through chemical fertilizers. The proportion of major and micronutrients is not maintained properly due to poor knowledge regarding the function of major and micronutrients in plants. Farmers use high rate of N and

P fertilizers than recommended doses

- **Technology description:** Groundnut is considered as an unpredictable legume crop. Yield varies widely from field to field and season to season. Number of factors are responsible for crop yield, out of them fertilizer management is one of the most vital factor for crop production. Among the various agro-techniques, the yield and quality are considerably influenced by the different nutrient management practices. The farmers of South Saurashtra agro-climatic zone growing *khariif* groundnut are advised to apply FYM @ 7.5 t/ha + recommended dose of fertilizer (RDF 12.5-25.00 kg NP/ha) + Zn @ 5 kg ha⁻¹ (ZnSO₄ @ 25 kgha⁻¹) through soil application and foliar application of urea @ 2% at 30 and 60 DAS for obtaining higher yield and net realization
- **Impact:** 1. Higher yield and net returns 2. Higher input use efficiency

Technology 14: Nutrient management practices for maximization of yield in summer groundnut

- **Duration:** summer 2010 to 2012
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra agro climatic zone of Gujarat
- **Existing practices:** Farmers are applying only major plant nutrients (NP) as basal application through chemical fertilizer. The proportion of major and micronutrients was not maintained properly due to poor knowledge of farmers regarding the function of major and micronutrients in significance of crop production
- **Technology description:** Application of 100 % recommended dose of fertilizers (25:50:00 NPK kg ha⁻¹) + FYM @ 7.5 t ha⁻¹ as basal + 50% RDF (12.5:25:00 NPK kg ha⁻¹) as top dressing at 30 DAS
- **Impact:** 1 Higher pod yield and haulm yield (increased 23.1 and 17.6 % respectively)
2 Increased net return (Rs. 72748/ha) and B:C (3.19) ratio

Technology 15: Nutrient management in prevalent groundnut-based cropping system

- **Duration:** *khariif* 2013 to 2015
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra agro climatic zone of Gujarat
- **Existing practices:** Farmers generally adopting *khariif* groundnut *rabi* wheat cropping sequence in Gujarat and applied higher dose of fertilizers as a basal in soil. The farmers are not much aware about the use of fertilizers to groundnut –wheat cropping sequence
- **Technology description:** The maximum yield and economics from *khariif* groundnut followed by wheat crop sequence is realized with application of 100 % N + 125 % P (12.5-31.25-0 NPK kg/ha) to groundnut and 100% RDF (120-60-40

NPK kg/ha) to *rabi* wheat. pod equivalent yield and net returns of groundnut crop increased 19.6 and 15.2 % (Fig. 14)

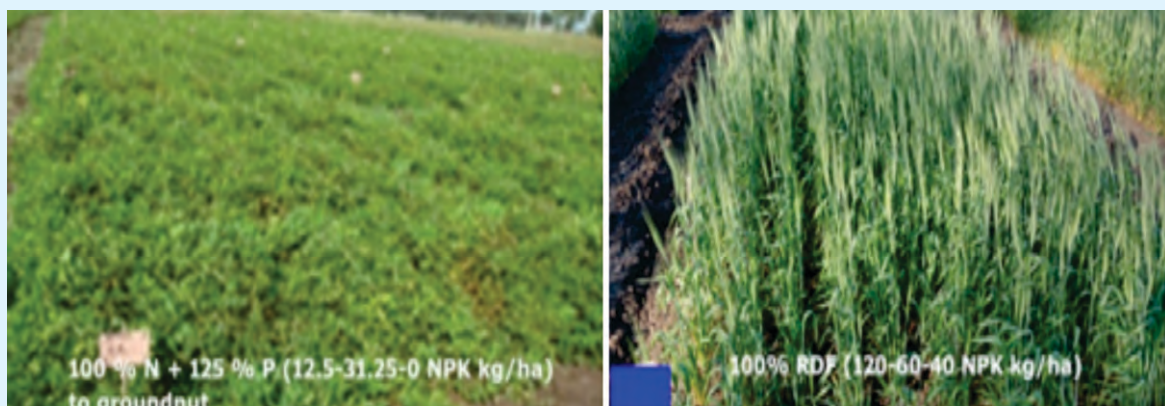


Fig. 14: Application of 100% N +125 % P (12.5-31.25-0 NPK kg/ha) to groundnut (L) and application of 100% RDF (120-60-40 NPK kg/ha) to wheat crop (R)

- **Impact:** Higher pod equivalent yield (19.6%) and net realization (₹17140) from *kharif* groundnut

Technology 16: Fertilizer doses and plant population for summer groundnut under fertigation

- **Duration:** summer 2013 to 2015
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra agro climatic zone of Gujarat
- **Existing practices:** Farmers generally apply flood irrigation and higher doses of fertilizers and grow summer groundnut at 30 x 10 cm spacing with 3.33 lakh plants per ha
- **Technology description:** Groundnut sowing at 20 x 10 cm spacing (5.00 lakhs plants/ha) with 75% RDF (18.75:37.50:00 kg NPK/ha) as WSGF (17-44-00 kg NPK/ha) in five equal splits through fertigation using drip irrigation at 0.8 PET (60 cm lateral and 45 cm dripper) at an interval of 8 days starting from 20 DAS is recommended. Also apply initially two normal irrigations for plant establishment
- **Impact:** About 23% water and 25% fertilizer saving besides higher pod yield (19-21%), economic return and WUE (3.88 kg/ha mm)

Technology 17: DAPG-producing fluorescent pseudomonads for enhancing nutrient use efficiency, bio-control of soil-borne diseases and yield of *kharif* groundnut

- **Duration:** *kharif* 2014 to 2016
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya

- **Recommendation domain:** South Saurashtra agro climatic zone of Gujarat
- **Existing practices:** Farmers are not scheduling nutrient management appropriately and do not apply bio- inoculants
- **Technology description:** Application of DAPG-4 bio-inoculant as seed treatment is recommended for obtaining higher yield and net realization with lower incidence of collar and stem rot
- **Impact:** 1. Higher pod yield (31%) with highest net return (₹ 69739/ha) and BCR (2.96)
2. Reduced incidence of collar rot and stem rot
3. Higher nutrient use efficiency

Technology 18: DAPG- producing fluorescent pseudomonads for enhancing nutrient use efficiency, bio-control of soil-borne diseases and yield of summer groundnut

- **Duration:** summer 2014-15 to 2016-17
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra Zone of Gujarat (Zone VII)
- **Existing practices:** Seed treatment with *Trichoderma* spp.
- **Technology description:** Seed inoculation with DAPG 4 and DAPG 2 was recorded to give significantly higher pod yield and haulm yield as compared to rest of the treatments. Seed treatment with DAPG 4 and DAPG 2 suppressed soil-borne fungal diseases like collar rot and stem rot of groundnut as compared to control
- **Impact:** 1. Pod yield increased (24 to 29%) over non application of bio-inoculants
2. Seed treatment with DAPG 2 and DAPG 4 reduced stem rot and collar rot incidence

Technology 19: Integrated phosphorus management in groundnut for higher P use efficiency

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. PM Vaghasia and Dr. KL Dobariya
- **Recommendation domain:** South Saurashtra Zone of Gujarat (Zone VII)
- **Existing practices:** Farmers use only synthetic chemical fertilizers
- **Technology description:** Application of 5.0 t FYM/ha + 100% P (25 kg/ha) + DGRC 1 strain is recommended for higher pod yield, haulm yield, kernel yield, oil yield and higher net return
- **Impact:** Higher pod yield (43 %) net return (Rs. 66098/ha) and B:C (2.66) ratio

AICRPG center-Kadiri

Technology 1: Groundnut cultivars for late sown conditions

- **Duration:** *kharif* 2009 to 2011
- **Scientists involved:** Dr. Sampath Kumar and Dr. Lokanatha Reddy
- **Recommendation Domain:** Scarce rainfall zone of Andhra Pradesh
- **Existing practice:** The onset of S.W. Monsoon is usually delayed and farmers mostly sow groundnut before 2nd week of July. Sowings will be taken up even in 1st week of August with the receipt of meagre rains which results in poor yields. Selection of suitable variety for such late sown conditions may avoid complete crop loss
- **Technology description:** Kadiri 9 and Kadiri Harithandhra varieties are promising for late sown conditions and July 2nd fortnight is the best time for sowing for rainfed groundnut (Fig. 15)



Fig. 15: Groundnut cultivars for late sown conditions at Kadiri

- **Impact:** Minimizes yield losses under late sown conditions

Technology 2: Effective weed management in *kharif* groundnut

- **Duration:** *kharif* 2006 to 2008
- **Scientists involved:** Dr. Sampath Kumar and Dr. Lokanatha Reddy
- **Recommendation Domain:** Scarce rainfall zone of Andhra Pradesh
- **Existing practice:** For controlling the weeds in groundnut, hand weeding is most popular method among the farmers which is very expensive, laborious and sometimes damaging to the crop plants. Generally farmers practice two hand weedings at 15 and 30 DAS and usage of pre-emergence herbicide is very less among the farmers
- **Technology description:** Pre-emergence application of Pendimethalin @ 1.0 kg a.i./ha + one hand weeding at 30 DAS is recommended as best feasible integrated weed

management practice for groundnut considering the present condition of scarcity and high cost of labour, effective weed control, yield and B:C ratio of cultivation of groundnut

- **Impact:** 1. Effective weed control
2. Solves the issue of labour shortage

Technology 3: Use of post-emergence herbicides in groundnut

- **Duration:** *kharif* 2006 to 2008
- **Scientists involved:** Dr. Sampath Kumar and Dr. Lokanatha Reddy
- **Recommendation Domain:** Scarce rainfall zone of Andhra Pradesh
- **Existing practice:** Generally farmers practice two hand weeding at 15 and 30 DAS. Pendimethalin as pre-emergence application to control weeds in groundnut is being practiced by some farmers. However, combined use of pre and post emergence herbicides will have better weed control efficiency
- **Technology description:** Pre-emergence application of pendimethalin @ 1.0 kg a.i./ha + one hand weeding at 30 DAS proved practically more convenient and economically best feasible integrated weed management practice for groundnut. However, if hand weeding is not possible, pre-emergence application of pendimethalin @ 1 kg a.i./ha combined with post-emergence application of either quizalofop-ethyl @ 50 g a.i./ha or imazethapyr @ 75 g a.i./ha could be used as an alternative method of weed control in *rabi* groundnut
- **Impact:** 1. Effective weed control
2. Higher yield of groundnut
3. Solves the labour scarcity problem

Technology 4: Nutrient management practices for yield maximization in groundnut

- **Duration:** *kharif* 2011 to 2013
- **Scientists involved:** Dr. Sampath Kumar and Dr. KSS Naik
- **Recommendation Domain:** Scarce rainfall zone of Andhra Pradesh
- **Existing practice:** Groundnut crop is mostly cultivated under low input management conditions during *kharif* under rainfed conditions. Farmers generally apply low quantity of fertilizers for rainfed groundnut thereby leading to lower yield. In order to maximize the yield of rainfed groundnut nutrient management is a vital factor
- **Technology description:** Application of recommended dose of NPK @ 20-40-50 kg/ha + FYM @ 7.5 t/ha is recommended for higher yield over application of recommended doses of fertilizers
- **Impact:** Sustainably higher yield

Technology 5: Maximization of *kharif* groundnut production under resource constraint situation

- **Duration:** *kharif* 2011 to 2013
- **Scientists involved:** Dr. Sampath Kumar and Dr. KSS Naik
- **Recommendation Domain:** Scarce rainfall zone of Andhra Pradesh



Fig. 16: Technologies for resource constraint conditions in groundnut at Kadiri

- **Existing practice:** Farmers generally cultivate rainfed groundnut under low input management conditions. Most of the farmers do not follow all the improved package practices like seed treatment, recommended dose of fertilizers, chemical weed management and plant protection measures due to resource constraint situation and frequent failure of the crop due to unfavourable weather conditions. Hence prioritization of production factors is necessary for getting higher yield under rainfed conditions
- **Technology description:** Among the production factors, weed management was found as the most prioritized production factor as weeds caused 65.2 % yield reduction in rainfed groundnut (Fig. 16). Nutrient application and plant protection were found next prioritised factors for maximum returns with constrained resources
- **Impact:** Maximum returns with limited resources

AICRPG Center-Puducherry

Technology 1: Paclobutrazol on growth and yield of *kharif* groundnut

- **Duration:** *kharif* 2014 and 2015
- **Scientists involved:** Dr. S Ravi, Dr. Mohan A Savery and Dr. V Kumar
- **Recommendation domain:** East coast south zone of Puducherry region.
- **Existing practices:** DAP 2% foliar spray at 35 - 45th DAS
- **Technology description:** The application Paclobutrazol @ 200 ppm with two spraying at 30 and 50 Days after Emergence (DAE) in groundnut was remunerative and increase 28 % of pod yield over control, net return and BCR (1.87) (Fig. 17)



Fig. 17: Effect of paclobutrazol spray in groundnut

- **Impact:** 1. Increase the yield in *kharif* season
2. Increase 28 % in pod yield and BCR (1.87)

Technology 2: Tank mix application of post-emergence herbicides for efficient weed control in *rabi*-summer groundnut

- **Duration:** *rabi*/summer 2014-15 to 2017- 18
- **Scientists involved:** Dr. S Ravi, Dr. Mohan A Savery, Dr. B Ramakichenin and Dr. S Vasanthakumar
- **Recommendation domain:** East coast south zone of Puducherry region.
- **Existing practices:** Two to three hand weeding at 15, 30 and 45 DAS
- **Technology description:** Pre-emergence application of Pendimethalin @ 1.5 kg a.i/ha (PE) followed by tank mix application of 50 % of each of Imazethapyr @ 37.5 g a.i/ha + Quizalopfop ethyl @ 25 g a.i/ha at 20-30 DAS as early post-emergence (Fig. 18) for effective weed management and higher pod yield (58%) of irrigated groundnut over control, net return and BCR (2.83)



Fig. 18: Pre- emergence application of Pendimethalin @ 1.5 kg a.i/ha (PE) followed by tank mix application of 50 % of each of Imazethapyr @ 37.5 g a.i/ha + Quizalopfop ethyl @ 25 g a.i/ha at 20-30 DAS (L) and Weedy check (Control) (R)

- **Impact:**
 1. Effective weed control
 2. Solves the issue of labour shortage
 3. Reduces the weed management cost
 4. Increase 59 % in pod yield and BCR

AICRPG center- Rahuri

Technology1: Water soluble foliar grade fertilizers in groundnut

- **Duration:** summer 2012-2014
- **Scientists involved:** Dr. RP Andhale, Dr. VL Amolic, Dr. SM Dhadage, Dr. NS Ugale, Dr. SS Ubale and Dr. RW Bharud
- **Recommendation Domain:** Scarcity Zone (Zone VI) of Maharashtra
- **Existing practice:** The farmers are not much aware about the use of water soluble foliar grade fertilizers to groundnut crop. Only fertilizers are applied as a basal dose to groundnut. Groundnut being an unpredictable legume its response to soil applied fertilizers is always not optimistic. The groundnut productivity in Maharashtra is low due to several production constraints, which include poor and imbalanced nutrition of crop and growing crop on marginal lands
- **Technology description:** The groundnut productivity can be enhanced by supplying adequate but balanced amounts of major and micronutrients. The nutrient requirement of groundnut is high especially at pegging and pod development stages. The requirement at these stages cannot be fulfilled merely by soil application alone and need to be supplemented through foliar application. Hence, application of FYM @ 7.5 t ha⁻¹ with 100% recommended fertilizer dose (25:50:00 NPK kg ha⁻¹) and foliar application of 2% water soluble grade fertilizers with starter dose of 11:36:24 at 30 DAS and booster dose of 8:16:39 at 45 DAS is recommended for higher yield and economic returns. Application of water-soluble fertilizers which is applied directly to the aerial portion of plants through foliar application is advantageous in terms of its low application rate, uniform distribution and quick response to applied nutrients

Package of technology recommended for higher yield of summer groundnut

- Application of FYM @ 7.5 t/ha + gypsum @ 400 kg/ha in soil 7 days before sowing followed by harrowing for uniform mixing in soil
- Seed treatment with biofungicide *Trichoderma* @ 5 g / kg seed before sowing and bio-fertilizer (*Rhizobium* and PSB) @ 250 g/10 kg of seed each
- Application of 100% of recommended dose of nutrients (N – 25 kg/ha, P₂O₅ – 50 kg/ha) at the time of sowing
- Foliar application of 11:36:24 @ 2% at 30 DAS (Flowering stage)
- Foliar application of 8:16:39 @ 2% at 45 DAS (peg formation stage)
- Foliar application of 8:16:39 @ 2% at 60 DAS (pod formation stage)
- **Impact:** 1. Increase in yield (109%) and net returns (Rs. 48734/ha)
2. Higher nutrient use efficiency

Technology 2: Nutrient management practices for production maximization in *rabi/summer groundnut*

- **Duration:** summer 2010 to 2012
- **Scientists involved:** Dr. RP Andhale, Dr. VL Amolic and Dr. RW Bharud
- **Recommendation domain:** Western Maharashtra Scarcity Zone (Zone VI).
- **Existing practices:** Groundnut crop is cultivated with 100% RDF as basal dose
- **Technology description:** Application of 75% RDF (18.75:37.5:0 NPK kg/ha) as basal and 75% RDF (18.75:37.5:0 NPK kg/ha) as top dressing at 30 DAS
- **Impact:** Technology is recently developed and just spreading among the farmers. The impact analysis of this technology is to be assessed in due course of time

Technology 3: Fertilizer doses and plant population for *rabi/summer groundnut*

- **Duration:** *rabi/summer* 2013-14 to 2015-16
- **Scientists involved:** Dr. RP Andhale, Dr. VL Amolic and Dr. RW Bharud
- **Recommendation domain:** Transition zone II (Western Maharashtra)
- **Existing practices:** Sowing at 30 x 10 cm spacing (3.33 lakh plants/ha) with 100% RDF (25:50:00 NPK kg/ha)
- **Technology description:** Groundnut sowing at 25 x 10 cm spacing (4.00 lakhs plants/ha) with 100% RDF (25:50:00 NPK kg/ha)
- **Impact:** About 12% more yield with highest net return and BCR (2.59) over existing practise

AICRPG center- Shirgaon

Technology 1: Tillage and sowing options for *rabi*-summer groundnut

- **Duration :** *rabi* 2008-09 to 2010-11
- **Scientists involved:** Shri.VN Shetye, Shri MP Gavai, Dr. UB Apate, Dr. BD Waghmode and Dr. UV Mahadkar
- **Recommendation domain:** South Konkan and North Konkan coastal zone of Maharashtra (AER 19)
- **Existing practice:** In Konkan condition majority of farmers prefer conventional tillage practice with conventional cultivation. That practice leads to hard pans in soil due to peculiar rice cropping system and tends to more soil erosion. Also, less availability of residual soil moisture to *rabi* crop and loss/immobility of nutrients
- **Technology description:** The tillage operations carried out by use of rotavator and modified method of criss-cross sowing was most suitable for increasing the yield of crop. The tillage operations carried out by rotavator reduced the soil compaction which further increased infiltration rate and soil moisture conservation leading to higher crop yield
- **Impact:** 1. Higher yield (43.9%) and net returns (113.5%)
2. Maintenance of higher soil moisture content

Technology 2: Micronutrient management in *kharif* groundnut

- **Duration :** *kharif* 2009 to 2011
- **Scientists involved:** Shri. VV Sagvekar, Dr. BD Waghmode, Dr. UB Apate, Shri VN Shetye, Dr. SA Chavan and Dr. UV Mahadkar
- **Recommendation domain:** South Konkan and North Konkan coastal zone of Maharashtra (AER 19)
- **Existing practice:** Generally farmers use low rate of fertilizers as compared to recommended dose of fertilizers i.e. 25:50:00 NPK kg ha⁻¹. Mostly farmers use mixed fertilizers and have less awareness about micronutrient use in groundnut crop. In coastal Konkan regions, soils under rice belt have natural soil acidity, common deficiency of zinc and boron
- **Technology description:** In order to overcome micro-nutrient deficiency, basal application of zinc through zinsulphate @ 20kg/ha and boron through boric acid @ 6 kg/ha along with recommended dose of fertilizer i.e. 25:50:00 kg NPK ha⁻¹ is recommended for better yield
- **Impact:** Higher yield (18.9) and net returns (71.2%)

Technology 3: Effective weed control in *rabi* groundnut

- **Duration :** *rabi* 2009-10 to 2011-12
- **Scientists involved:** Shri. VV Sagvekar, Dr. BD Waghmode, Dr. UB Apate, Shri VN Shetye, Dr. SA Chavan and Dr. UV Mahadkar
- **Recommendation domain:** South Konkan and North Konkan coastal zone of Maharashtra (AER 19)
- **Existing practice:** Groundnut crop is highly susceptible to weed infestation because of its slow growth in the initial stages up to 40 days, short plant height and underground pod bearing habit. In groundnut weeds comprise diverse plant species ranging from grasses to broad-leaf weeds and sedges, and cause substantial yield losses which are more in rainfed spanish bunch type than in irrigated *virginia* type groundnut. In India, yield losses of groundnut due to weeds ranges from 24-70 per cent. Besides this, weeds are preferred host of several insect-pests, and the vectors of many important organisms causing diseases in groundnut. For controlling weeds in groundnut, hand weeding is most popular method among the farmers which is very expensive, laborious and sometimes damaging to the crop plants



Fig. 19: Effect of pre emergence weedicide and one hand weeding on weed control

Fig. 20: Effect of pre emergence and post emergence weedicide on weed control

- **Technology description:** Herbicides were found to be selective in controlling many weeds in mono-cropping as well as in cropping systems. Herbicides, though, selective, efficient and cost effective weed control measure in controlling weeds in groundnut, the maximum benefit can be achieved by combining herbicides with manual, cultural and mechanical weed control methods. These methods of weed control also vary with the groundnut growing situation and the cropping systems. Hence, pre-emergence application of *pendimethalin* @ 1.0 kg a.i./ha + one hand weeding at 30 DAS proved practically more convenient and economically best feasible integrated weed management practice for groundnut considering the present condition of scarcity and high cost of labours, quality of weed control, yield and B:C ratio of cultivation of groundnut (Fig. 19). If hand weeding is not possible,

pre-emergence application of *pendimethalin* @ 1 kg a.i./ha combined with post-emergence application of either *quizalofop-p-ethyl* @ 50 g a.i./ha or *imazethapyr* @ 75 g a.i./ha could be used as alternative method of weed control in *rabi* groundnut (Fig. 20)

- **Impact:** Technology is recently developed and just spreading among the farmers

Technology 4: Nutrient management practices for production maximization of *rabi* groundnut

- **Duration:** *rabi* 2009-10 to 2011-12
- **Scientists involved:** Shri. VV Sagvekar, Dr. BD Waghmode, Dr. UB Apte, Shri VN Shetye, Dr. SA Chavan and Dr. UV Mahadkar
- **Recommendation domain:** South Konkan and North Konkan coastal zone of Maharashtra (AER 19)
- **Existing practice:** Most farmers use comparatively low rate of fertilizers as compared to recommended dose of fertilizers i.e. 25:50:00 NPK kg ha⁻¹ and whole quantity of fertilizers are applied at the time of sowing of crop. In Konkan region, acidic lateritic soils leads to less availability of nutrients to crop at later growth stages. The nutrients applied at the time of crop sowing gets fixed in soil and are not available at later stage (productive phase) of the crop
- **Technology description:** The optimization of the mineral nutrition plays key role in production maximization of groundnut. Hence in order to address this issue, application of 100% RDF (25:50:00 NPK kg ha⁻¹) as basal dose + 50% RDF (12.5:25:00 NPK kg ha⁻¹) as top dressing at 30 DAS (Fig. 21) was found superior for not only higher pod, kernel and haulm yield but also for net returns over 100% RDF as basal

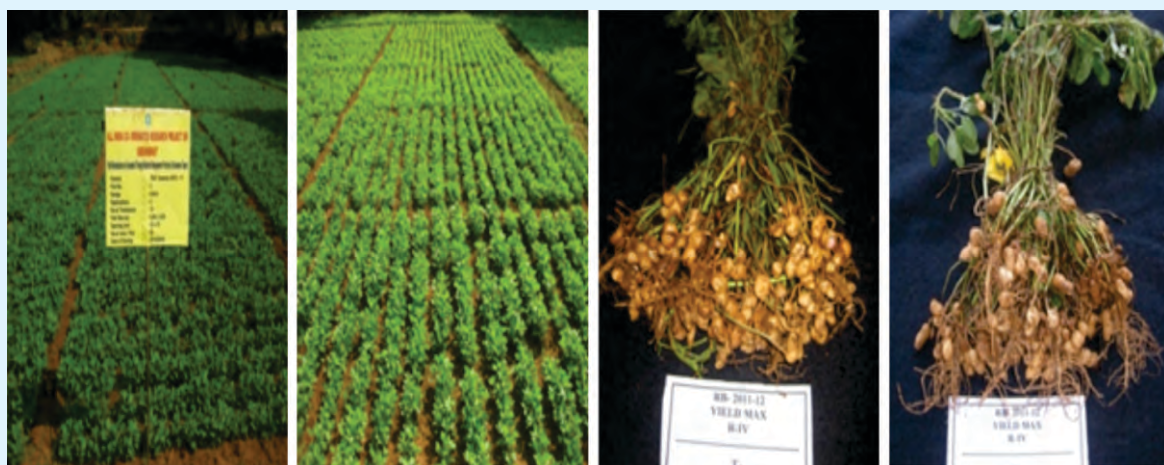


Fig. 21: Groundnut with application of 100% RDF at sowing and 50% Of RDF as top dressing

- **Impact:** Higher yield (24%) and net returns (145%)

Technology 5: To optimize *kharif* groundnut production under resource constraint conditions

- **Duration :** *kharif* 2011 to 2013
- **Scientists involved:** Shri. VV Sagvekar, Dr. BD Waghmode, Dr. SA Chavan, Dr. BR Salvi, Dr. UV Mahadkar and Dr. KE Lawande
- **Recommendation domain:** South Konkan and North Konkan coastal zone of Maharashtra (AER 19)
- **Existing practice:** There are several constraints in groundnut production in which proper fertilizers, plant protection and weeding often pose serious problems. Generally, farmers are not able to follow recommended package of practices for production maximization due resource constraint situation of small and marginal farmers. Therefore, there is need to prioritize the management practices to get maximum returns from available resources with the farmers
- **Technology description:** Application of full package as per recommendation produced significantly higher pod, kernel and haulm yield over application of full package excluding fertilizer, plant protection and weeding (Fig. 22). Hence, under economical resource constraint give first preference to fertilizer management followed by weed management and plant protection measures for obtaining higher productivity and profit from *kharif* groundnut under lateritic soils of *Konkan*. The reduction in the pod yield due to exclusion of fertilizer, plant protection and weeding over application of full of package of practices was to the tune of 39.3, 20.8 and 31.5 per cent, respectively

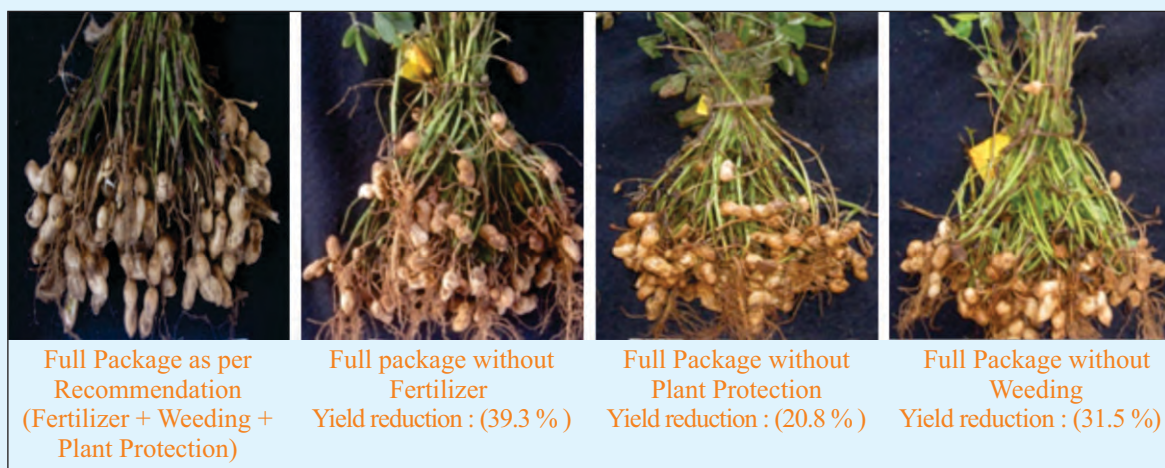


Fig. 22: Production technologies for higher yield of groundnut under resource constraint conditions of Shirgaon

- **Impact:** Maximum returns under resource constraint situation

Technology 6: Water soluble foliar grade fertilizers in groundnut

- **Duration:** *rabi* 2011-12 to 2013-14
- **Scientists involved:** Shri. VV Sagvekar, Dr. BD Waghmode, Dr. VC Navhale, Dr. SA Chavan, Dr. BR Salvi, Dr. UV Mahadkar and Dr. KE Lawande
- **Recommendation domain:** South Konkan and North Konkan coastal zone of Maharashtra (AER 19)
- **Existing practice:** Farmers are not much aware about the use of water soluble foliar grade fertilizers to groundnut crop. Only conventional fertilizers are applied as a basal dose to crop. Groundnut being an unpredictable legume its response to soil applied fertilizers is not optimistic in most of the time and soils of *Konkan* region are acidic in nature that leads to fixation or leaching losses of the nutrients
- **Technology description:** The combination of soil as well as foliar application of fertilizers was found to be better over soil application alone. Hence, application of FYM @7.5 t ha⁻¹ with 100 % recommended fertilizer dose (25:50:00 NPK kg ha⁻¹) and foliar application of 2 % water soluble grade fertilizers with starter dose of 11:36:24 NPK kg ha⁻¹ at 30 DAS and booster dose of 8:16:39 NPK kg ha⁻¹ at 45 DAS is recommended for higher yield and economic returns (Fig. 23). Application of water soluble fertilizers which might be applied directly to the aerial portion of plants through foliar application is advantageous in terms of its low application rate, uniform distribution and quick response to applied nutrients



Fig. 23: Effect of foliar application of water-soluble fertilizers in groundnut

- **Impact:** 1. Higher yield and net returns
2. Higher nutrient use efficiency

Technology 7: Pre-germinated seeds for higher germination in *kharif* groundnut

- **Duration :** *kharif* 2012 to 2014
- **Scientists involved:** Shri. VV Sagvekar, Dr. BD Waghmode, Dr. AS Kamble, Dr. VC Navhale, Dr. BR Salvi, Dr. SA Chavan, Dr. UV Mahadkar and Dr. KE Lawande

- **Recommendation domain :** South Konkan and North Konkan coastal zone of Maharashtra (AER 19)
- **Existing practice :** Intense rainfall with uneven distribution is major constraint for normal crop growing in Konkan condition. In *kharif* season groundnut sowing commences with early onset of monsoon by majority of the farmers but, sowing has to be completed under intense rainfall condition due to incessant rains which leads to delayed and lower germination, because of decreased soil temperature and higher percentage of mortality
- **Technology description:** The general purpose of seed priming is to partially hydrate the seed to a point where germination triggers but not completed. Seed is soaked in water for 4 hrs and tied in wet cotton cloth bag for 24 hrs, and kept in shade for sprouting. With sprouted seeds sowing can be done even upto 27th meteorological week (2-7 July) as against normal 25th meteorological week (18-24 June). For *konkan* region, groundnut crop sown on 25th MW (18-24 June) with normal (un-sprouted) seeds, while under delayed condition groundnut crop sown with sprouted seed and sown on 27th MW (2-7 July) is recommended (Fig. 24). With this practice under delayed sowing condition in heavy rainfall condition one can achieve the par yield of groundnut



Fig. 24: Effect of different treatments on germination in groundnut

- **Impact:** 1. Higher germination percentage and plant stand
2. Higher yield and net returns

Technology 8: Nutrient management in groundnut-rice cropping system

- **Duration:** *rabi* 2012-13 to *kharif* 2015
- **Scientists involved:** Shri. VV Sagvekar, Dr. BD Waghmode, Dr. AS Kamble, Dr. VC Navhale, Dr. BR Salvi, Dr. UV Mahadkar and Dr. SA Chavan
- **Recommendation domain:** South Konkan coastal zone of Maharashtra (AER 19)
- **Existing practice:** In few pockets of Konkan region farmers follow the groundnut-rice cropping system. But, most of farmers are not much aware about the

recommended packages of practices followed for groundnut-rice cropping system.

- **Technology description:** The nutrient management in groundnut–rice cropping system plays a dominant role in increasing the productivity as well as maintaining the soil health. Continuous cropping results in rapid decline in soil fertility and thus requires special attention. Hence, it is recommended to apply 100 % N + 150 % PK (25 kg N + 75 kg P₂O₅ + 0 kg K₂O/ha) to groundnut and 75 % RDF i.e. 75 kg N + 37.5 P₂O₅ + 37.5 kg K₂O ha⁻¹ to rice under South *Konkan* coastal conditions for higher yields and economic returns from *rabi* groundnut- *kharif* rice system (Fig. 25)



Fig. 25: Field performance of rice-groundnut cropping system

- **Impact:** 1. Higher system yield and net returns
2. Higher nutrient use efficiency
3. Maintenance of soil health

Technology 9: Suitable land configuration and mulching for *kharif* groundnut

- **Duration :** *kharif* 2013 to 2015
- **Scientists involved:** Dr. AS Kamble, Dr. BD Waghmode, Shri. VV Sagvekar, Dr. VC Navhale, Dr. BR Salvi, Dr. UV Mahadkar and Dr. SA Chavan
- **Recommendation domain:** South and North *Konkan* coastal zone of Maharashtra (AER 19)
- **Existing practice :** Most of the farmers of *konkan* region follow groundnut sowing on flat bed i.e. conventional method behind the plough. The use of polythene or organic mulching is still not much common among the farmers. This existing practice may lead to hardening of soil pan and less infiltration of rain water which leads to runoff erosion in heavy rainfall condition
- **Technology description:** The broad bed & furrow (BBF) technique provides loose soil mass for development of pods. As groundnut pods grow underground, therefore the loose and well aerated seed bed is important for penetration of pegs and development of pods. Besides this the ridges and furrows are useful both for irrigation and drainage of excess water as *konkan* region has excessive and uneven rainfall distribution pattern. The land configuration like BBF can increase infiltration of rainwater and thus helps to improve moisture storage in soil profile. Also, various

materials like straw, hay, trashes, dry leaves etc. have been used for long back as natural mulch to conserve soil moisture, arrest weed growth and improve soil physical properties (Fig. 26). Suitable land configuration and mulching (polythene/farm waste) provides congenial condition for growth and development of crop. Growing of groundnut using BBF (with four rows on each bed of around 1.1 m width and plant spacing of 80-20 cm) along with 7 micron polythene mulch (44 kg ha⁻¹) resulted in higher yields and economic returns



Fig. 26: Different land configuration and mulching techniques used in groundnut

- **Impact :**
 1. Better peg penetration and pod development
 2. Maintenance of higher soil moisture content
 3. Lesser weed infestation
 4. Higher yield and net returns

Technology 10: Nutrient management practices for yield maximization in *kharif* groundnut

- **Duration:** *kharif* 2011 to 2013
- **Scientists involved:** Shri. VV Sagvekar, Dr. BD Waghmode, Dr. VC Navhale, Dr. BR Salvi, Dr. SA Chavan, Dr. UV Mahadkar and Dr. KE Lawande
- **Recommendation domain :** South *Konkan* coastal zone of Maharashtra
- **Existing practice:** Application of 5 tonne FYM with 25 kg N+50 kg P₂O₅+0 kg K₂O/ha

- **Technology description:** Application of FYM @ 7.5 t ha⁻¹ + RDF (25 kg N + 75 kg P₂O₅ + 0 kg K₂O/ha) with soil application of critical micronutrients and foliar application of urea @ 2% at 30 and 60 DAS
- **Impact :** High pod yield and high net returns

Technology 11: Water soluble foliar grade fertilizers (WSGF) for *rabi*-summer groundnut

- **Duration :** *rabi*/summer 2011-12 to 2013-14
- **Scientists involved:** Shri. VV Sagvekar, Dr. BD Waghmode, Dr. VC Navhale, Dr. BR Salvi, Dr. SA Chavan, Dr. UV Mahadkar and Dr. KE Lawande
- **Recommendation domain:** South Konkan Coastal Zone of Maharashtra (Zone I)
- **Existing practices:** Application of 5 tonne FYM with 25 kg N + 50 kg P₂O₅ + 0 kg K₂O/ha
- **Technology description:** Use of FYM @ 7.5 t/ha and 100% RDF (25 kg N + 75 kg P₂O₅ + 0 kg K₂O/ha) as basal and foliar spray of WSGF @ 2% of starter dose 11:36:24 at 30 DAS and booster dose of 8:16:39 at 45 and 60 DAS
- **Impact :** Higher pod yield (12.6%) and net returns (Rs. 8024/ha)

Technology 12: Fertilizer doses and plant population for summer groundnut

- **Duration :** *rabi*/summer 2013-14 to 2015-16
- **Scientists involved:** Dr. BD Waghmode, Dr. AS Kamble, Dr. VC Navhale, Dr. BR Salvi, Dr. SA Chavan, Dr. UV Mahadkar and Dr. T Battacharya
- **Recommendation domain :** South Konkan coastal zone of Maharashtra
- **Existing practices :** Groundnut sowing at 30x15cm spacing (2.22 lakhs plants/ha) with 100% RDF (25:50:00 NPK kg/ha)
- **Technology description:** Groundnut sowing at 30 x 15cm spacing (2.22 lakhs plants/ha) with 125% RDF (31.25:62.50:00 kg/ha NPK) is recommended
- **Impact:** About 13% higher pod yield and additional net returns of Rs.11427/ha over existing practice

Technology 13: Mulching, hydrogel and nutrient management for summer groundnut

- **Duration :** *rabi*/summer 2013-14 to 2015-16
- **Scientists involved:** Shri. VV Sagavekar, Dr. BD Waghmode, Dr. AS Kamble, Dr. VC Navhale, Dr. BR Salvi, Dr. SA Chavan, Dr. UV Mahadkar and Dr. T Battacharya
- **Recommendation domain:** South Konkan coastal zone of Maharashtra
- **Existing practices:** Groundnut sown without mulching and hydrogel using some inorganic and organic fertilizers with 12–13 normal irrigations
- **Technology description:** Application of white polythene mulch of 7 micron

thickness @ 55 kg/ha with soil application of hydrogel @ 5.0 kg/ha with INM (FYM @ 7.5t/ha+ RDF; 25:50:00 kg/ha) is recommended for higher production, profit and WUE in summer groundnut

- **Impact :** Saving 25% water with higher WUE (3.31 kg/ha mm), pod yield (16-21%) and net returns (24-32%) over existing practice

Technology 14: DAPG-producing fluorescent pseudomonades for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of *kharif* groundnut

- **Duration :** *kharif* 2014 to 2016
- **Scientists involved:** Dr. BD Waghmode, Dr. AS Kamble, Dr. VC Navhale, Dr. BR Salvi, Dr. SA Chavan, Dr. UV Mahadkar and Dr. T Battacharya
- **Recommendation domain:** South Konkan coastal zone of Maharashtra
- **Existing practices:** Farmers do not follow seed treatment for groundnut sowing, sometimes seed treated with *Trichoderma* spp.
- **Technology description:** Application of FP-98 or *Trichoderma* spp. bio-inoculants as seed treatment along with RDF (25:50:00 kg/ha NPK) is recommended for higher pod yield, economics and lesser incidence of collar rot and stem rot
- **Impact :** Higher pod yield (49%) with an additional net returns of Rs. 36303/ha over existing practice but found on par to *Trichoderma* spp.

Technology 15: DAPG- producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of summer groundnut

- **Duration :** *rabi*/summer 2014-15 to 2016-17
- **Scientists involved:** Dr. AS Kamble, Dr. BD Waghmode; Dr. VC Navhale, Dr. BR Salvi, Dr. SA Chavan, Dr. UV Mahadkar and Dr. T Battacharya
- **Recommendation domain :** South *Konkan* coastal zone of Maharashtra
- **Existing practices :** Seed treatment generally not followed by the farmers
- **Technology description :** Application of DAPG producing fluorescent pseudomonads is recommended for higher yield, net returns, B:C ratio and lowest incidence of stem rot and collar rot in *rabi* groundnut under lateritic soils of Konkan
- **Impact :** Pod yield increased by about 45 percent over control.

Technology 16: Integrated phosphorus management in *kharif* groundnut

- **Duration :** *kharif* 2015 to 2017
- **Scientists involved:** Dr. AS Kamble, Dr. BD Waghmode, Dr. VC Navhale, Dr. BR Salvi, Dr. SA Chavan, Dr. UV Mahadkar and Dr. T Battacharya

- **Recommendation domain :** South Konkan coastal zone of Maharashtra
- **Existing practices :** Farmers are not following seed treatment and use less doses of fertilizers i.e. 50 % P and 5 ton FYM/ha
- **Technology description :** In lateritic soil of Konkan, for exploiting native soil phosphorus for groundnut production during *kharif* season, seed treatment with DGRC-1 @ 1250 gm/ha is recommended with 100 percent of recommended dose of fertilizers (25:50:00 NPK kg ha⁻¹)
- **Impact :** Higher pod yield (16%) with an additional net returns of Rs 10,387/ha over existing practice (50 % P and 5 ton FYM/ha)

Technology 17: Optimization of *rabi* groundnut under resource constraints

- **Duration :** *rabi* 2013-14 to 2015-16
- **Scientists involved:** Dr. BD Waghmode, Dr. VV Sagavekar, Dr. AS Kamble, Dr. VC Navhale, Dr. BR Salvi, Dr. SA Chavan, Dr. UV Mahadkar and Dr. T Battacharya
- **Recommendation domain :** South Konkan coastal zone of Maharashtra
- **Existing practices :** Farmers not following seed treatment and use less doses of fertilizers i.e. 50 % P and 5 ton FYM/ha
- **Technology description :** The full package of practice i.e. FYM @7.5 t ha⁻¹, 25:50:00 NPK kg ha⁻¹, plant protection and weeding
- **Impact :** The net returns by excluding the fertilizer, plant protection and weeding measures from full package were reduction in sequence was Rs. 55538/ha, Rs. 38171/ha and Rs. 10370/ha, with benefit to cost ratios of 1:1.81, 1:1.38 and 1:1.41 respectively

AICRP center-Tindivanam

Technology 1: DAPG-producing fluorescent pseudomonads for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of *kharif* groundnut

- **Duration :** *kharif* 2015 to 2017
- **Scientists involved:** Dr. K Sathiya and Dr. R Vaidyanathan
- **Recommendation domain :** North eastern zone of Tamil Nadu
- **Existing practices :** Seed treatment with *Trichoderma* spp
- **Technology description :** Application of DAPG 4 recommended for higher yield. Seed treatment with *Trichoderma viridi* reduced stem rot and collar rot incidence followed by treatment with DAPG 4 (Fig. 27)



Fig. 27: Impact of seed treatment with DAPG 4 in groundnut

- **Impact:** 1. Pod yield increased (8.8%)
2. Reduced incidence of stem rot (3.0) and collar rot (3.7)

Technology 2: Tank mix application of post-emergence herbicides for efficient weed control in *kharif* groundnut

- **Duration :** *kharif* 2015 to 2017
- **Scientists involved:** Dr. K Sathiya and Dr. R Vaidyanathan
- **Recommendation domain :** North eastern zone of Tamil Nadu
- **Existing practices :** Two hand weeding or application of pendimethalin @ 1.5 kg a.i/ha (PE) + one hand weeding at 25 DAS
- **Technology description :** Pre emergence application of pendimethalin @ 1.5 kg a.i/ha (PE) followed by tank mix application of 50 % of each of imazethapyr @ 37.5 g a.i/ha + quizalopofop ethyl @ 25 g a.i/ha at 20-30 DAS (Fig. 28) as early post emergence for effective weed management and higher yield of groundnut



Fig. 28: Herbicide spray and its impact on groundnut

- **Impact :** Increase in pod yield by 58% over control and 3 % over the existing practice of two hand weeding. Increase in benefit cost ratio by 1.5 times over control, Increased weed control efficiency by 82.10 %, controls both monocot and dicot weeds

Technology 3: Integrated phosphorus management in *kharif* groundnut

- **Duration :** *kharif* 2015 to 2017
- **Scientists involved:** Dr. K Sathiyaa and Dr. R Vaidyanathan
- **Recommendation domain :** North eastern zone of Tamil Nadu.
- **Existing practices:** Seed treatment (400g) and soil application of phosphobacteria (10 kg/ha)
- **Technology description :** Application of 5.0t FYM/ha+100% RDP (50 P₂O₅kg/ha) and either DGRC 1 or DGRC 2 culture improved groundnut pod yield (Fig. 29)
- **Impact :** Pod yield increased (5.9 %) over the non-application of strains



Fig. 29: Application of 5 t FYM/ha + 50 kg P₂O₅/ha + seed treatment with DGRC 2 and its effect in groundnut

AICRPG center-Tirupati

Technology 1: DAPG-producing fluorescent pseudomonads for nutrient use efficiency, bio-control of soil-borne diseases and yield of *kharif* groundnut

- **Duration :** *kharif* 2015 to 2017
- **Scientists involved:** Dr. P Maheswara Reddy, Dr. G Krishna Reddy and Dr. RP Vasanthi
- **Recommendation domain :** Southern zone of Andhra Pradesh
- **Existing practices :** Seed inoculation with *Rhizobium*, PSB and *Trichoderma* is followed by few farmers for enhancing nutrient use efficiency and for the control of soil borne diseases
- **Technology description :** Seed inoculation with DAPG-4, DAPG-2 and FP-98 as low cost technology has beneficial effect on groundnut for enhancing nutrient use efficiency and bio-control of soil borne diseases
- **Impact:** Higher pod yield (10-19%) with reduced incidence of soil borne diseases (25-60%)

Technology 2: Tank mix application of post-emergence herbicides for efficient weed control in *kharif* groundnut

- **Duration :** *kharif* 2015 to 2017
- **Scientists involved:** Dr. P Maheswara Reddy and Dr. RP Vasanthi
- **Recommendation domain :** Southern zone of Andhra Pradesh
- **Existing practices :** Two hand weedings at 20 and 40 DAS
- **Technology description :** Pre emergence application of pendimethalin @ 750 g a.i/ha followed by post emergence application of imazethapyr @ 75 g a.i./ha when weeds are at 2-5 leaf stage at 15-20 DAS is recommended for effective weed control and higher monetary returns from groundnut
- **Impact:** Higher pod yield (17%), weed control efficiency (98.4) and lowest weed index (6.0) and higher net returns (Rs22802/ha) has been realized with recommended practices over the existing practice of hand weeding twice by farmers at 20 and 40 DAS

Technology 3: Integrated phosphorus management in *kharif* groundnut

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. P Maheswara Reddy, Dr. G Krishna Reddy and Dr. RP Vasanthi
- **Recommendation domain:** Southern zone of Andhra Pradesh
- **Existing practices:** Application of recommended dose of phosphorus @ 40 kg per

hectare. Seed treatment with *Rhizobium* and *Trichoderma* is practiced by farmers

- **Technology description:** Seed inoculation with DGR cultures (DGRC-1 and DGRC-2) as low cost technology has beneficial effect on groundnut for enhancing nutrient use efficiency by decreasing phosphatic fertilizer usage by 50% which will help the farmers to reduce the cost of cultivation
- **Impact:** Rs. 940 per hectare can be saved by the farmers by applying only 50% of the recommended phosphatic fertilizer

Technology 4: DAPG- producing fluorescent pseudomonads for nutrient enhanced use efficiency, bio-control of soil-borne diseases and yield of *rabi* groundnut

- **Duration :** *rabi* 2015-16 to 2017-18
- **Scientists involved:** Dr. P Maheswara Reddy, Dr. G Krishna Reddy and Dr. RP Vasanthi
- **Recommendation domain :** Southern zone of Andhra Pradesh
- **Existing practices :** Seed inoculation with *Rhizobium*, PSB and *Trichoderma* is followed by few farmers for enhancing nutrient use efficiency and for the control of soil borne diseases
- **Technology description :** Seed inoculation with DAPG-2 and DAPG-4 as low cost technology has beneficial effect on *rabi* groundnut for enhancing nutrient use efficiency and bio-control of soil borne diseases
- **Impact :** Higher per hectare pod yield (32.5%), net monetary returns (Rs. 34659/ha) with reduced incidence of soil borne diseases (50-70%) over the control were realized in *rabi* groundnut

AICRPG Center- Vriddhachalam

Technology 1: Nutrient management practices for production maximization in *rabi*/summer groundnut

- **Duration :** *rabi*/summer 2009 to 2012
- **Scientists involved:** Dr. R Vaidyanathan and Dr. K Subrahmaniyan
- **Recommendation domain :** North eastern zone of Tamil Nadu
- **Existing practice :** Application of 100 % RDF (17:34:54 NPK kg/ha) as basal
- **Technology description :** Application of 75% RDF (13:25:40 NPK kg/ha) as basal and 75% RDF (13:25:40 NPK kg/ha) as top dressing at 30 DAS in addition to FYM @ 7.5 t ha⁻¹ as basal is recommended
- **Impact :** Higher yield (16 % increase) and net returns

Technology 2. Post emergence herbicide for groundnut

- **Duration:** *kharif* 2010 to 2013
- **Scientists involved:** Dr. R Vaidyanathan, Dr. C Harisudan and Dr. K Subrahmaniyan
- **Recommendation Domain:** North Eastern Zone of Tamil Nadu
- **Existing practice:** Pre-emergence application of pendimethalin @ 1 kg a.i./ha combined with one hand weeding at 25 days after sowing for effective and profitable weed control in *kharif* and *rabi*/summer groundnut
- **Technology description:** Pre-emergence application of pendimethalin @ 1 kg a.i./ha should be supplemented with post-emergence application of either quizalofop ethyl @ 50 g a.i./ha or imazethapyr @ 75 g a.i./ha if labour is not available for manual weeding at 25 DAS
- **Impact:** 1. Effective weed control and higher crop yield
2. Solves labour shortage problem

Technology 3. Seed drill sowing and seed treatment for irrigated groundnut

- **Duration:** *kharif* 2010 to 2013
- **Scientists involved:** Dr. R Vaidyanathan and Dr. K Subrahmaniyan
- **Recommendation Domain:** North eastern zone of Tamil Nadu
- **Existing practice:** Sowing behind the country plough and dibbling with hand hoe.
- **Technology Description:** Sowing with seed drill (seed rate based on 100 kernel weight and germination percent) and seed treatment with Mancozeb @ 3g/kg seed + soil application of *Trichoderma viride* @ 2.5 kg/ha (FYM based) before sowing for reducing plant mortality and incidence of stem rot
- **Impact:** 1. Optimum plant stand. 2. Higher yield and net returns

Technology 4. Split application of fertilizers to irrigated groundnut

- **Duration:** *kharif* 2011 to 2014
- **Scientists involved:** Dr. R Vaidyanathan, Dr. C Harisudan and Dr. K Subrahmaniyan
- **Recommendation domain:** North eastern zone of Tamil Nadu
- **Existing practice:** Application of 100% RDF+FYM @ 7.5 t/ha as basal
- **Technology description:** Application of 100% RDF (25:50:75 Kg NPK/ha) + FYM @ 7.5 t/ha as basal + 50% RDF (12.5:25:37.5 kg NPK/ha) as top dressing at 30 DAS is recommended
- **Impact:** Higher yield and net returns

Technology 5: Nutrient management in prevalent groundnut-based cropping system

- **Duration:** *kharif* 2013 to 2015
- **Scientists involved:** Dr. C Harisudan, Dr. K Subrahmaniyan and Dr. P Parasuraman
- **Recommendation domain:** North eastern zone of Tamil Nadu
- **Existing practice:** Application of RDF 25:50:75 kg NPK/ha to groundnut and 25:50:25 kg NPK/ha to blackgram
- **Technology description:** The maximum yield and net returns from *kharif* groundnut followed by blackgram crop sequence can be realized with application of 25 kg N + 75 kg P/ha to *kharif* groundnut and 75% RDF (18.75:37.5:18.75 kg NPK/ha) to *rabi* blackgram
- **Impact:**
 1. Higher yield (16%) and net realization (Rs. 16073/ha) from *kharif* groundnut
 2. Saving of 25% RDF in subsequent black gram crop without significant yield losses

Technology 6: Tank mix application of post-emergence herbicides for efficient weed control in *kharif* groundnut

- **Duration:** *kharif* 2014 to 2016
- **Scientists involved:** Dr. P Parasuraman and Dr. V Karunakaran
- **Recommendation domain:** North eastern zone of Tamil Nadu
- **Existing practice:** Two hand weeding or application of pendimethalin @ 1.5 kg a.i/ha (PE) + one hand weeding at 25 DAS
- **Technology description:** In case of labourer shortage it may be recommended for application of pendimethalin @ 1.5 kg a.i/ha (PE) followed by each tank mix application of imazethapyr @ 37.5 g a.i/ha + quizalopofop ethyl @ 25 g a.i/ha at 20-30 DAS as early post-emergence for effective weed management
- **Impact:** Increase in pod yield up to 27% over the existing practice

Technology 7: DAPG-producing fluorescent pseudomonas for enhanced nutrient use efficiency, bio-control of soil-borne diseases and yield of *kharif* groundnut

- **Duration:** *kharif* 2014 to 2016
- **Scientists involved:** Dr. P Parasuraman and Dr. V Karunakaran
- **Recommendation domain:** North eastern zone of Tamil Nadu
- **Existing practice:** Seed treatment with *Trichoderma* spp.
- **Technology description:** Seed treatment with DAPG-4 producing fluorescent pseudomonas for reduced incidence of collar rot and root rot diseases
- **Impact:** Reductions in collar rot (60%) and stem rot (31 %) incidence

Technology 8: Integrated phosphorus management in *kharif* groundnut.

- **Duration:** *kharif* 2015 to 2017
- **Scientists involved:** Dr. P Parasuraman and Dr. V Karunakaran
- **Recommendation domain:** North eastern zone of Tamil Nadu
- **Existing practice:** Seed treatment with 3 packets (600 g/ha) or soil application with 10 packets (2000 g/ha) of Phosphobacteria
- **Technology description:** Application of 5 t FYM/ha + 100% P (50 kg/ha) + DGRC 2 is recommended for obtaining higher yield
- **Impact:** About 4-6% more pod yield over existing practice



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किसानों का हमसफर
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*Agri*search with a *h*uman touch

