Compiled Report
(April 2017 to March 2019)

Scaling up and popularization of high yielding pigeonpea hybrids for enhancing productivity of small and marginal farmers of Telangana, Andhra Pradesh, Karnataka, Maharashtra and Orissa states of India

Submitted to
Ministry of Agriculture and Farmers Welfare,
Department of Agriculture and Co-operation and Farmers Welfare
(NFSM Cell – Crops division)

ICRISAT DEVELOPMENT CENTER

ICRISAT

INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS

Contents

1. Executive summary

To harness the potential benefits of hybrid pigeonpea in the state of Maharashtra, Karnataka, Andhra Pradesh, Telangana and Odisha through science-led participatory research for development, and to increase system productivity and profitability for small farm holders, the Mission Program on popularizing pigeonpea hybrid (ICPH 2740) was approved by Department of Agricultural Cooperation and Farmers Welfare, Government of India in 2017 for two years. During 2017-18, an ICRISAT-led consortium provided technical support to formulate, monitor and demonstrate science-led best management practices through this initiative and able to cover 170 ha area whereas during 2018-19, the consortium covered 6000 ha area in 14 districts across five states viz., Maharashtra, Karnataka, Andhra Pradesh, Telangana and Odisha by adopting participatory approaches. This was achieved through cooperation from agricultural department, consortium of different stakeholder's viz., KVKs, NGOs, Community Block Organizations and progressive farmers.

The goal of the hybrid pigeonpea upscaling project is to enhance the farmer's income through an integrated and participatory knowledge-led farming systems development approach for increasing pigeonpea productivity. The specific objectives of this project are:

- To enhance the productivity of pigeonpea-based systems using high-yielding hybrids along with improved land, water and crop management practices including soil test-based nutrient management options.
- To promote cultivation of high-yielding pigeonpea hybrid ICPH 2740 under black soils with one or two protective irrigations.
- To develop village-level seed systems to achieve self-sufficiency in seeds of farmer-preferred improved varieties of pigeonpea.
- To build capacity of farmers and Self Help Groups (SHGs) in sustainable pigeonpea production technology components as well as sensitization of the policy makers for sustainable pigeonpea production techniques in the targeted states.

The ICRISAT-led consortium technically supported the activities to implement various improved technologies which can lead pigeonpea productivity in pilots. During the project period, pilot districts across four states (except Odisha) recorded a lowest rainfall events with a prolonged dry spells 15-20 days duration coupled with critical crop growth stages which has affected crop productivity but still the productivity was better than the local best check. In Odisha, after good early rainfall, there was a long dry spell at the time flowering. Even under these precarious weather, the hybrid pigeonpea performed very well compared to other varieties which were severely affected and wilted due to prolonged moisture stress. The pigeonpea hybrid ICPH 2740 has shown a high vigour and excellent growth even during severe moisture stress. The other technologies promoted in the project include balanced nutrient management, landform management including broad bed, ridge and furrow system, seed dibbling, nipping to induce secondary and tertiary branches, integrated pest management using neem oil and emamectin benzoate application. Further, timely irrigation and weed management contributed towards excellent crop growth and vigour of hybrid pigeonpea across all pilot sites in these three states. Despite wide spread crop failure of majority of agricultural crops in Parbhani, Hingoli, Amravati, Bidar, Kalburgi and Raichur district during bothy the years, the ICPH2740 recorded average productivity of 20.7 q/ha during 2017-18 and 15-18 q/ha during 2018-19 as compared to other existing cultivars.

2. About the Crop

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is one of the major pulse crop grown in semi-arid tropics in India. It occupies a prominent place in rainfed agriculture in the country and is a major source of dietary protein and other essential amino acids. It is an integral component of various agricultural production systems in the country and is grown either as sole crop or as inter crop with cereals, pulses, cotton, oilseeds and millets. Pigeonpea accounts for ~5% of global acreage (4.16 m ha) and production of (2.85 m t) and is cultivated in 22 countries, Asia is nearly sole contributor. Pigeonpea is cultivated in 4.42 m ha in India and its production and productivity are 2.89 m t and 655 kg/ha respectively. The crop is extensively grown in many of the Indian states i.e. UP, MP, Maharashtra, Karnataka, AP, Telangana, Gujarat etc.

Pigeonpea is mainly consumed as split dal throughout the country and has several other uses of various parts of pigeonpea plant. Enhancing the productivity of the crop assumes specific significance in India mainly to combat protein malnutrition as it is the main source of protein to the predominant vegetarian population. A majority of Indians being vegetarian, the availability and affordability addresses the problem of malnutrition in the country.

Among the pigeonpea cultivating states, Maharashtra (15.33 Lakh Ha) and Karnataka (12.14 lakh ha) account for major share in the country in terms of area and production. Due to many biotic and abiotic factors, the yields of pigeonpea remained low. The productivity remained stagnant since last few decades. Among various constraints, biotic and abiotic stress is major factors that affect the productivity of pigeonpea inn India. Further, pigeonpea is a majorly grown by small and marginal farmers as sole crop and as intercrop with cotton, soybean, pulses, groundnut and millets. Boosting of pigeonpea production in these states poses a greater challenge to many of the agricultural scientists. To address the low productivity issues, hybrid pigeonpea was developed by ICRISAT scientists that have potential to yield higher than conventional and local low yielding varieties. Further, with regard to enhance the productivity, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has conceived a mission mode project on hybrid pigeonpea and is technically supporting for scaling out the pigeonpea area through State's department of agriculture, NGOs, lead farmers, Self-help groups etc in many states of India. Presently, the project is conceived to operate in five states i.e. Telangana, Andhra Pradesh, Karnataka, Maharashtra and Odisha. This is a science-led development approach launched by the GoI to improve livelihoods of million families of small and marginal rainfed farmers in these state through innovations through DoA with the help and guidance from ICRISAT.

3. Rationale

Pigeonpea being a drought tolerant crop, is environment-friendly crop with qualities of improving soil fertility and structure. Pigeonpea dal is a staple food across the country and plays an important role in national economic and nutritional security. The annual production of this pulse in India is about three million tons; but this quantity is insufficient to meet the domestic needs; and hence a considerable amount (about 500,000 t) of pigeonpea is imported each year. Enhancing the productivity of the crop assumes specific significance in India mainly to combat protein malnutrition as it is the main source of protein to the predominant vegetarian population. The national demand of pigeonpea in India always scores over the production, and in spite of decades of research and development programs, the mean productivity of the crop could not cross 800 kg/ha. To break this yield plateau ICRISAT in collaboration with ICAR led to evolution of stable and standardized hybrid breeding technology, globally the first in any food legume. This technology is based on cytoplasmic nuclear male sterility (CMS) and natural out-crossing. There is substantial increase in yield and net income by the cultivation of the hybrids in rainfed and irrigated ecosystems which demands for expansion of area under hybrids to break the yield stagnation

in the crop. The hybrids ICPH 2671, ICPH 2740, ICPH 3762, ICPH 3933 were extensively tested in Maharashtra, Karnataka, Telangana, Odisha and Madhya Pradesh states of India through multi-location and on farm testing trials. In the last four years three commercial hybrids have been released in India, and these have demonstrated 30-50% yield advantage over the most popular local cultivars in farmers' fields with resistance to fusarium wilt and sterility mosaic disease. Considering performance of pigeonpea hybrids, which has a potential to make India self-sufficient in meeting its internal demand, need was felt to popularize and increase the uptake of this important technology across India. With this scenario, project entitled "Scaling up and popularization of high yielding pigeonpea hybrids for enhancing productivity of small and marginal farmers of Maharashtra, Karnataka and Odisha states of India" was implemented through funding from National Food Security Mission (NFSM), which is a stepping stone to take this important technology to the door steps of farmers in a big way. Thus, high-yielding diseases resistant hybrids along with improved land, water and crop management practices including soil test-based nutrient management approach was followed to enhance productivity of pigeonpea based cropping system through this project

4. Mission Goal

The goal of the hybrid pigeonpea upscaling project is to operationalize an integrated and participatory knowledge-led farming systems development approach for increasing pigeonpea productivity by in next four years through convergence and better coordination amongst different agriculture research-extension and development sectors for sustainably improving the income of the farmers through empowerment, capacity development with knowledge-based and market oriented farmers' centric partnership approach.

5. Objectives

The specific objectives of the Program are:

- To enhance the productivity of pigeonpea-based systems using high-yielding hybrids along with improved land, water and crop management practices including soil test-based nutrient management options.
- To promote cultivation of early maturing high-yielding pigeonpea hybrids in Alfisols and medium duration hybrids in Vertisols.
- To develop village-level seed systems to achieve self-sufficiency in seeds of farmer-preferred improved varieties of pigeonpea.
- To build capacity of farmers and Self Help Groups (SHGs) in sustainable pigeonpea production technology components as well as sensitization of the policy makers for sustainable pigeonpea production techniques in the targeted states.
- To provide technical back-stopping for refinement of pigeonpea production technologies and also undertake strategic research to address the constraints identified by the farmers and other stakeholders in the target areas.

6. Project Locations

For demonstrating the potential benefits of best practices that enhance the pigeonpea productivity, three districts from each of the five states viz, Maharashtra (Amravati, Parbhani and Osmanabad), Karnataka (Bidar, kalaburgi and Raichur), Telangana (Adilabad, Mahaboobnagar, Rangareddy), Andhra Pradesh (Kurnool, Prakasham) and Odisha (Rayagarah, Kalahandi and Bodh) were

targeted during 2017-18 and 2018-19 cropping season (Fig. 1). However, during 2017-18, we could practically covered 170 ha demonstrations in three districts only viz, Raichur, Bidar and Parbhani, but during 2018-19, in all the identified districts (except Guntur), field demonstrations on pigeonpea were conducted successfully.

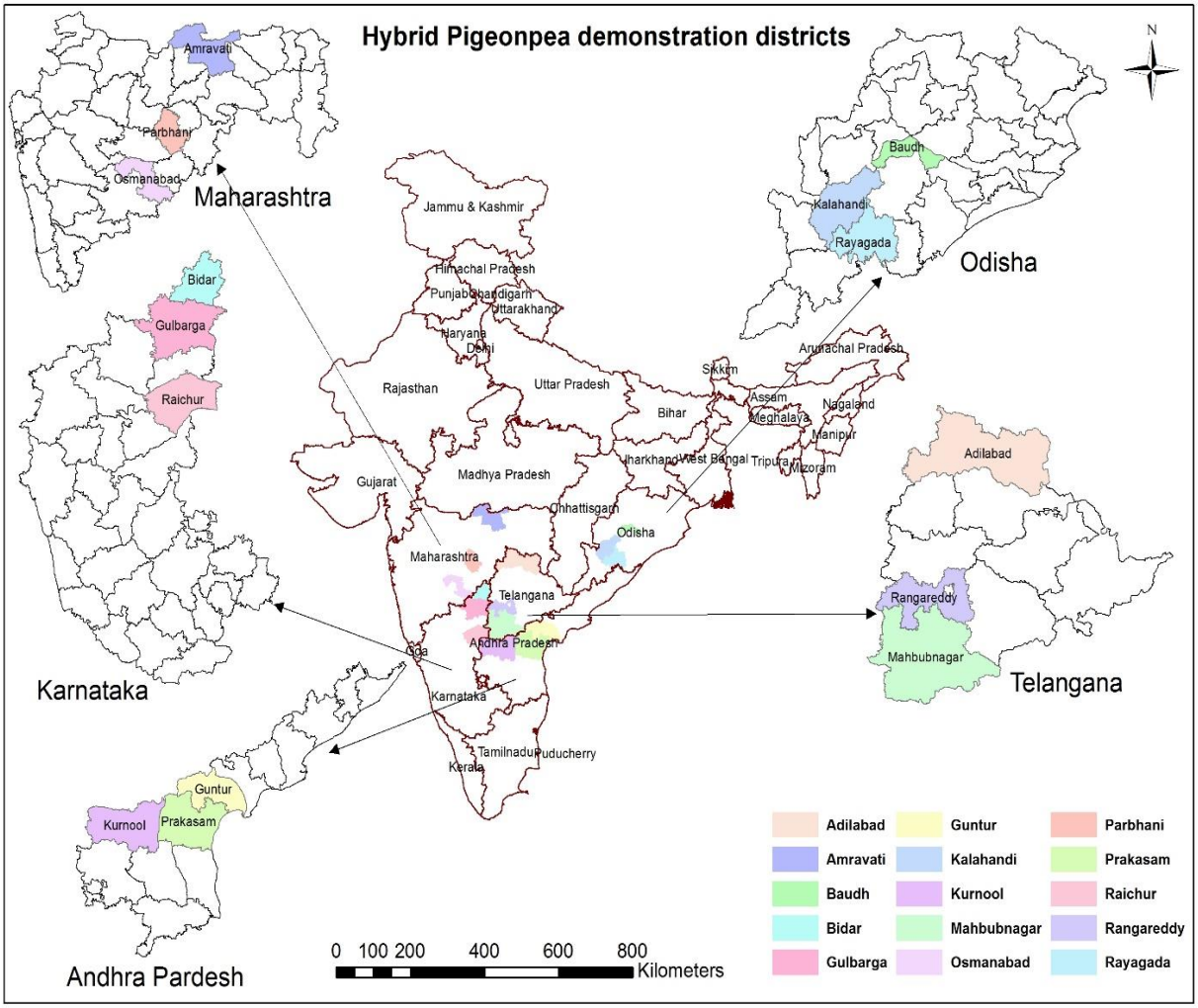


Fig 1. Project locations for productivity enhancement in pigeonpea in five

7. Consortium partners

The consortium comprised of State Department of Agriculture (Karnataka, Maharashtra, Odisha, Andhra Pradesh, Telangana), and SAUs, Krishi Vigyaan Kendras in the state, NGO partners (viz, Manik foundation, CARDS, Chaitanya Youth Association, PROTECT, BISLD, Dhan Foundation, READ, Loksebak, Harsha Trust, Udyama. National seeds cooperation, Community-based Organizations (CBOs), and International Crops Research Institute for the Semi-Arid Tropics, (ICRISAT) for facilitation of improved technologies to all stakeholders along with participating farmers.

8. Project strategy

The most important strategy for this initiative is to strengthen the consortium of all the stakeholders involved in the mission mode project on popularizing hybrid pigeonpea in India for getting higher productivity and there by production. The salient strategies adopted by the consortium are the principle of 4 ICEs as indicated – I's: Innovative, Inclusive, Integrated, Intensification; C's: Collective, Cooperation, Capacity-Building, Consortium; E's: Efficiency, Equity, Environment protection, Economic gain. The consortium will be of knowledge transforming development agencies such as state departments viz Department of Agriculture, State Seeds Corporation, etc. along with knowledge generating academic and research institutions like State Agricultural Universities (SAUs), and ICRISAT for improving the economic gain of the rural poor in rainfed area.

9. Agricultural technologies promoted

9.1 Hybrid pigeonpea ICPH 2740

The high yielding pigeonpea hybrid ICPH 2740 was promoted in 2 districts viz, Raichur (100 ha area), Bidar (55 ha) and Parbhani district of Maharashtra (15 ha area). The targeted number of demonstrations could not be achieved during 2017-18 due to non-availability of seed as well as late approval of the project. However, during 2018-19, 14 districts covering five states (Table 1) were targeted and demonstrations were conducted. To overcome problems like sterility mosaic and wilting and incidence of pod borer are major constraints in realizing higher yield. Therefore, it was decided to promote potential pigeonpea hybrid which is not only high yielding but also resistant to sterility mosaic and wilt disease. Hybrid pigeonpea is the first in the crop (first in world in any legume), was developed by ICRISAT, ICAR, and partners under a project supported by ISOPOM, Ministry of Agriculture, Government of India. This hybrid is found most promising with respect to yield, stability and disease resistance and is resistant to shattering and have more root biomass compared to other existing varieties. The special characteristic of the hybrids is the good dal quality and by most (80%) respondents it was rated as "better than the market sample" in flavor, taste, and cooking time.

Seeds were supplied to various districts under project targeting 500 ha per district. The recommended seed rate @ 5 kg per ha was supplied to all the project farmers. During 2017-18, 4 t seed was supplied whereas during 2018-19, 37.5 t of pigeonpea seed which was procured from National Seed Corporation, were supplied under the project.

***Fig 2: Hybrid pigeonpea ICPH2740 seed distribution in project area*.**

Table 1: Area coverage under hybrid pigeonpea demonstrations during project period				
State	**District**	**No of Villages**	**No of farmers covered**	**Achieved Area (ha)**
A. 2017-18				
1. Karnataka	Raichur	3	45	100
	Bidar	2	15	15
2. Maharashtra	Parbhani	3	15	25
	Total area covered during 2017-18			**115**
B. 2018-19				
1. Andhra Pradesh	Kurnool	29	639	510
	Prakasam	17	283	446
2. Karnataka	Bidar	12	513	549
	Kalaburgi	25	480	614
	Raichur	9	233	233
3. Maharashtra	Amravati	11	396	380
	Hingoli	9	21	92
	Parbhani	14	98	378
4. Odisha	Boudh	88	672	500
	Kalahandi	110	1104	500
	Raygada	75	954	500
5. Telangana	Adilabad	65	478	562
	Mahabubnagar	45	503	457
	Rangareddy	36	310	281
	Total area covered during 2018-19			**6002**

Similarly, other technological options that were identified for enhancing productivity and income to farmers and rural poor were given time-to-time. The technologies recommended and popularized in different districts for enhancing the benefits are balanced nutrient management including micro-nutrients, seed treatment, landform management and other best bet management practices.

9.2 Soil test based balanced nutrient management

Soil testing of individual farmer's field is useful to identify the nutrient deficiencies and estimate crop nutrient mining. So efforts were made to use the soil analysis results for balanced use of plant nutrients to correct nutrient deficiency, restoring soil fertility due to over exploitation, increase nutrient and water use efficiency, and enhances crop yields and farmers' income. Similarly, farmers were trained on soil sampling methodology and representative soil samples collection protocols. As a first step, soil sampling and diagnosing nutrient status of farmers' fields were evaluated for project area sites and based

on nutrient analysis results (Table 2) balanced nutrient recommendations were given. The analyses revealed that the soils are alkaline in nature and all the soils are low in organic carbon except Odisha (<0.5). Phosphorus (P) was sufficient in almost all samples, potassium (K) is rich in all the soils expect Boudh district of Odisha showing low content and zinc (Zn) were observed to be deficient in all districts except Bidar, Amravathi, Rayagada and Mahaboobnagar. Other micronutrients were observed sufficient in the samples and boron is sufficiently available in all the soils except in Odisha. To overcome the boron deficiency, Agribor (20.5% B) was made available @ 1 kg per acre to all the demo plots across the states.

Fig 3: Supplying 20% Boron to hybrid pigeonpea ICPH2740 growers

Table 2. Soil nutrient status of farmers field selected under NFSM project														
State	**District**	**pH**	**EC**	**OC**	**Av P**	**Av K**	**Av Ca**	**Av Mg**	**Av S**	**Av Zn**	**Av B**	**Av Fe**	**Av Cu**	**Av Mn**
			dS/m	**%**	**ppm**	**Ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**
Andhra Pradesh	Prakasham	7.64	0.33	0.36	12.31	204.24	1764	379.99	17.64	0.53	1.14	10.38	1.15	11.8
	Kurnool	8.09	0.5	0.34	13.11	148.9	4209	616.39	37.4	0.58	1.22	8.57	1.04	10.88
	Average	**7.86**	**0.42**	**0.35**	**12.71**	**176.57**	**2987**	**498.19**	**27.52**	**0.56**	**1.18**	**9.47**	**1.09**	**11.34**
Karnataka	Bidar	7.79	0.18	0.43	7.01	192	6033	1107	24.03	2.91	1.45	6.71	2.75	10.23
	Kalaburgi	7.89	0.2	0.37	5.22	249.5	6790	1093.5	5.12	0.26	0.59	4.38	1.9	5.89
	Yadgir	8.2	0.2	0.44	54.01	338.25	4849	627	11.96	0.31	1.24	2.4	1.04	3.99
	Average	**8.04**	**0.19**	**0.42**	**26.66**	**284**	**6088**	**908**	**10.42**	**0.62**	**1.01**	**4.14**	**1.79**	**6.26**
Maharashtra	Osmanabad	7.87	0.24	0.47	5.74	393	7436	1134	12.83	0.43	0.76	4.02	2.05	6.89
	Parbhani	8.24	0.21	0.36	6.85	314.33	6696	919.33	16.11	0.29	1.26	4.57	1.33	4.85
	Amravathi	7.86	0.32	0.44	5.99	375.71	5383	1583.43	-	0.88	0.63	7.64	2.36	4.3
	Average	**7.99**	**0.25**	**0.45**	**6.78**	**377**	**6838**	**1123**	**13.97**	**0.45**	**1.07**	**4.91**	**1.83**	**6.49**
Odisha	Boudh	5.86	0.09	0.49	12.64	55.08	1833	251.21	9.82	0.47	0.28	75.07	1.21	14.82
	Kalahandi	6.62	0.15	0.49	11.6	176.07	1818	325.84	11.03	0.42	0.29	18.88	1.15	35.52
	Rayagada	5.97	0.1	0.72	11.39	118.4	1246	296.68	10.72	0.61	0.34	62.33	1.58	32.07
	Average	**6.15**	**0.11**	**0.57**	**11.88**	**116.52**	**1632.3**	**291.24**	**10.52**	**0.5**	**0.31**	**52.09**	**1.31**	**27.47**
Telangana	Mahaboobnagar	7.44	0.28	0.41	5.6	91.35	1477.7	287.74	24.1	0.58	0.52	7.71	0.63	6.2

9.3 Seed treatment

Seed treatment with fungicide and insecticide is desirable to avoid damage to germinating tender seedlings from seed borne or soil borne fungi and insects for a month. Therefore, the hybrid pigeonpea seeds were treated with thiram @ 2.5 g/kg to control seed borne diseases. Pigeonpea being a legume crop, rhizobium treatment was given to pigeonpea seeds along with phosphate-solubilizing bacteria to help in increasing the nutrient availability. The seeds were treated with crop specific efficient biological nitrogen fixing bacterial (rhizobium) strains @ 250 g/10 kg of seed with an object to enhance nitrogen fixation. The farmers were linked to State Agriculture Department for purchasing rhizobium packets.

Fig 4: Training on seed treatment with rhizobium and PSB.

9.4 Landform management

Pigeonpea can be successfully grown on a wide range of soils. However, it needs good drainage in water logging soils. In vertisols, pigeonpea gets heavily damaged if water logging occurs during heavy rainfall which may lead to wilting. Farmers were also educated on different landforms that allows proper drainage such as Broad Bed and Furrow (BBF) system which also facilitates draining of excess rainwater as runoff and furrows act as traffic zones for plough bullocks. Knowledge and benefits of BBF was given to farmers during distribution of seeds. The advantages of BBF are listed below:

- The raised bed portion acts as an in-situ 'bund' to conserve more moisture and ensures soil stability; the shallow furrows provide good surface drainage to promote aeration in the seed and root zone; prevents water logging of crops growing on the bed.
- The BBF design is quite flexible for accommodating crops and cropping systems with widely differing row spacing requirements.
- Precision operations such as seed and fertilizer placement and mechanical weeding are facilitated by the defined traffic zone (furrows), which saves energy, time, cost operation and inputs.
- Reduces runoff and soil loss and improves soil properties over the years.
- Facilitates double cropping
- Improve crop yields

***Fig 5: Use of BBF maker in project area*.**

9.5 Best management practices in pigeonpea

9.5.1 Seed dibblers: Farmers were advised to follow line sowing as it not only helps in good crop growth but also in better management with view to control pest and diseases and for inter-cultivation operations. For reducing the labour usage and also to have uniform spacing, seed dibblers were provided in Karnataka three districts.

Fig 6: Line sowing and use of dibbler machine for sowing pigeonpea seeds for small and marginal farmers.

9.5.2 Nipping machines:

In order to induce more number of secondary and tertiary branches, removing the top shoot or apical bud (nipping) is advised in pigeonpea. In absence of nipping, the pigeonpea crop tends to grow vertical and thereby making pest control measures difficult due to increased plant height. Similarly, the

crop bears less pods due to excessive plant height. So efforts were made to promote the nipping operations in all the 14 districts across all five states. For facilitating this nipping operation, nipping machines @ 10 per district were provided across pilot districts from ICRISAT and necessary capacity building was given to farmers and all stakeholders. Nipping machine is a very simple which is the modified version of low volume sprayer that is been attached with the surgical blade for cutting the young twigs. Total of 125 nipping machines were given to the project districts under the project area.

Figure 7: Dr. Gajanan during training on nipping in pigeonpea with nipping machine at Parwa village, Parbhani, Maharashtra

9.6 Integrated pest management

Farmers were educated on integrated pest management in pigeonpea which was necessary to Controls the pest population below economically damaging threshold levels using a combination of all feasible control measures. The primary components of IPM promoted in pilot sites across all five states are effective monitoring using pheromone to monitor pests species viz., Helicoverpa sp. and Spodoptera sp. and to minimize pest infestation or damage through use of biopesticides like neem oil and green labeled insecticides. Neem oil (10000 ppm) was supplied to all the demo plots @ 1 liter per ha and green labeled insecticides (emamectin benzoate 5SG) was supplied to all the districts @ 250gm per ha. Total of 5687 liters of neem oil and 1404 kg of Emamectin benzoate was supplied to all the respective project areas under the project during 2018-19.

9.7 Capacity building

For ensuring successful pigeonpea cultivation, standard package of practices suitable for hybrid pigeonpea (ICPH 2740) were developed (**see Annexure II**) and shared with all the stakeholders. The farmers were trained on different aspects like, seed treatment, landform management, balanced fertilization including secondary and micro nutrients, integrated pest control measures etc. At each location, ICRISAT scientists, scientific officer, research technicians and NGOs were given responsibility for providing the handholding support to farmers along with local institutions and also to see the proper implementation of all the designated activities. Agriculture officers from Agriculture department and KVK scientist were also involved for proper implementation of the activities in many project sites.

9.8 Monitoring and evaluation

The efforts were made to frequently visit the demonstrations and provide the solutions on the spot to the farmers. Accordingly, the concerned scientists from ICRISAT visited the demonstrations during establishment phase, grand growth phase, flowering stage and grain filling stage.

Fig 8: Field days and experts visit to demo plots.

Fig 9: Capacity building and field day for promoting best management practices in pigeonpea

సేంద్రియ పద్ధతుల్లో సాగు చేయాలి

ఏడీఏ వినోద్‌కుమార్

నవాబుపేట :

సేంద్రియ పద్ధతుల్లో పంటలు సాగుచేయాలని ఏడీఏ వినోద్‌కుమార్ అన్నారు. శుక్రవారం మండల పరిధిలోని వట్టిమీనపల్లి గ్రామంలో రైతు రవీందర్ రావు కంది పంటను పరిశీలించారు. ఆయన మాట్లాడుతూ, సేంద్రీయ పద్ధతుల్లో ఎరువులు తయారు చేసుకుని పంట పొలాలకు వాడాలని సూచించారు. సైంటిఫిక్ ఆఫీసర్లు నాగరాజు, శ్రీనివాస్‌రావు మాట్లాడుతూ, శాస్త్రీయ పద్ధతుల్లో వ్యవసాయం చేయాలని రైతులకు సూచించారు. కార్యక్రమంలో రీడ్ సంస్థ మేనేజర్ రవీందర్, సీఈవో నవీన్ కుమార్, ఎస్ఏపీ కళాశాల రిటైర్డ్ ఉపన్యాసకులు ముత్తారెడ్డి, వాటర్‌షెడ్ చైర్మన్ గోపాల్‌రెడ్డి, రీసెర్చ్ టెక్నిషియన్లు సంగీత, రవీందర్, శేఖర్, శ్రీనివాస్, మాజీ సర్పంచ్ ప్రభాకర్‌రెడ్డి తదితరులు పాల్గొన్నారు.

కంది పంటను పరిశీలిస్తున్న ఏడీఏ వినోద్‌కుమార్

ఆంధ్రజ్యోతి Sat, 29 December 2018 https://epaper.andhrajyothy.com

'హైబ్రిడ్ విత్తనాలతో అధిక దిగుబడులు'

కంది పంటను పరిశీలిస్తున్న ఇక్రిశాట్ అధికారులు

దేవనకొండ, జనవరి 2: హైబ్రిడ్ విత్తనాలతో రైతులు అధిక దిగుబడులు సాధించవచ్చని ఇక్రిశాట్ అధికారి నాగరాజు, వాటర్‌షెడ్ ప్రాజెక్టు అధికారి మధుసూదన్ అన్నారు. బుధవారం మండలంలోని కొత్తపేట బస్టాండ్ సమీపంలో దేవనకొండకు చెందిన మహమ్మద్‌రఫీ అనే రైతు సాగుచేసిన కందిపంట దిగుబడిపై రైతులకు అవగాహన కల్పించారు. ఈ సందర్భంగా వారు మాట్లాడుతూ ఇక్రిశాట్ సంస్థ జిల్లాలో బనగానపల్లె, దేవనకొండ మండలాలకు పైలేట్ ప్రాజెక్టు కింద ఎంపిక చేసి రైతులకు ఉచితంగా కెపీహెచ్ 27-40 అనే రకం కంది విత్తనాలలో అగ్రిబోర్, యూనిక్‌యాసిడ్, బెంజోవెట్, నిమ్‌ఆయిల్ వంటి క్రిమిసంహారక మందులను అందజేస్తామన్నారు. వాతావరణ పరిస్థితులు అనుకూలిస్తే 27-40 అనే కంది వంగడం రైతులు ప్రత్యామ్నాయ పంట కింద వేసుకుంటే అధిక దిగుబడులను పొందవచ్చు నన్నారు. కార్యక్రమంలో వాటర్‌షెడ్ సిబ్బంది వెంకన్న, రాఘవరెడ్డి, వివిధ గ్రామాల రైతులు పాల్గొన్నారు.

ఆంధ్రజ్యోతి Thu, 03 January 2019 https://epaper.andhrajyothy.com/c/35424763

Fig 10: Newspaper clipping of field day conducted in project areas.

9.9 Cross-learning and capacity building

Cross-learning program was conducted on 18th and 19th February 2019. Farmers, stakeholders, scientists and officials from Department of Agricultural were invited from all the five states. In a two days cross-learning programme all the technical details of growing hybrid pigeonpea viz., its growth conditions, soil health status, nutrient requirements, seed production, plant protection, irrigation schedule, crossing and maintaining of parental lines were explained by ICRISAT scientists. Further interaction session between farmers and scientists was carried out to address the issues faced by farmers. Problems related to irrigation schedule, time of irrigation, plant health, pest and diseases problems faced by the farmers in growing hybrid pigeonpea were addressed by the scientists, and further farmers who reaped higher yields by cultivating hybrid pigeonpea were asked to share their experiences to the other fellow farmers. Meanwhile, a milestone achievement of few farmer from Osmanabad who reaped 4.2 tons per ha yield by cultivating hybrid pigeonpea along with best management practices, were shared with other farmers, who were skeptical about the yield potential of hybrid pigeonpea. From the experiences of farmers following points emerged as a take home must to follows practices: Early sowing of hybrid pigeonpea, as it 170-180 days crop late sowing causes delayed maturity and more pest problems; spacing of minimum 6 feet between rows and 2 feet between plant to plant, as more spacing provides plants with sufficient sunlight, less competition and more space for it luxurious growth. One compulsory irrigation during 75-

80 DAS (before flowering), if rains doesn't occur during this stage of crop growth and no irrigation during flowering stage as it induces more of vegetative growth.

10. Analyzing yield benefits through project interventions

Data on yield was reordered by conducting crop cutting experiments in all the districts of five states, respectively. For each district, 30-40 CCEs were conducted along by NGO partners, ICRISAT staffs, agricultural department officials etc and the data was compiled and analyzed. Altogether, 615 CCEs were conducted across project sites (Table 3). The yield data was compiled district wise and state wise and is used for comparison of project results.

Table 3. Details of pigeonpea demonstrations along with CCEs details across project sites

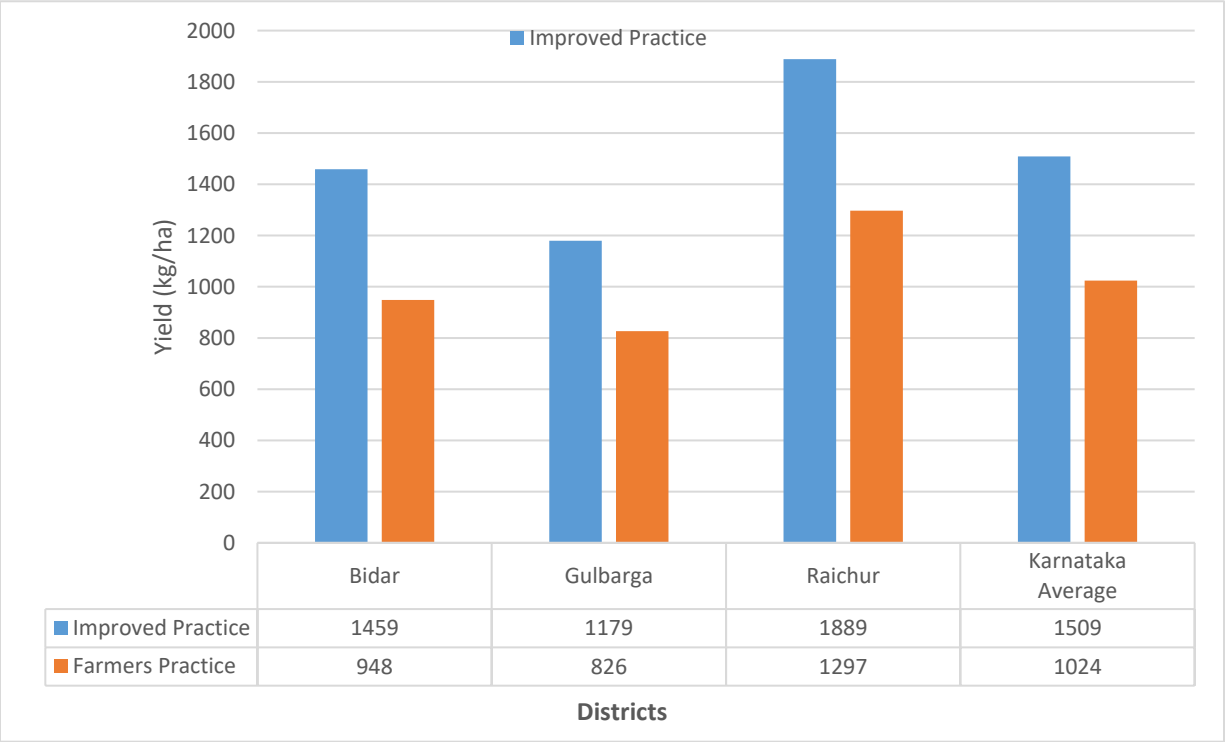
State	District	No. of CCEs
A. 2017-18		
1. Karnataka	Raichur	**15**
	Bidar	**15**
2. Maharashtra	Parbhani	**15**
B. 2018-19		
Andhra Pradesh	Kurnool	51
	Prakasam	36
Maharashtra	Amaravathi	
	Hingoli	9
	Parbhani Average	49
Odisha	Boudh	50
	Kalahandi	28
	Rayagada	51
Karnataka	Bidar	28
	Gulbarga	48
	Raichur	45
Telangana	Rangareddy	
	Adilabad	21
	Mahaboobnagar	35
	Wanaparthy	56
Total number of CCEs conducted during 2018-19		**615**

10.1 Karnataka

During 2017-18, two districts in Karnataka viz, Raichur and Bidar were targeted for altogether 155 ha field demonstrations on improvement management practices on hybrid pigeonpea. Performance of ICPH 2740 was measured by comparing with university released popular varieties viz, TS3R, Maruti and BDN709. Farmers expressed that the ICPH 2740 since beginning had vigorous growth with profuse branching and flowering compared to other high yielding variety. The data on pigeonpea yield revealed that farmers recorded average yield of 20.78 q/ha in Raichur with 17 % incremental yield advantage compared to local best variety; whereas it recorded 25 q/ha in Bidar (with 17.4% incremental yield advantage) as

compared to 18 q/ha with local variety. Overall, farmers are convinced with the high yield potential of ICPH 2740 in addition to resistance to major diseases and recorded yield advantage of 28 per cent in the targeted districts in Karnataka state.

During 2018-19, field demonstrations on pigeonpea were conducted in three districts of Karnataka viz, Bidar, Kalaburagi and Raichur @500 ha per district and covered altogether 1396 ha area. In all three districts, pigeonpea was grown in intercropping system with soybean (2:6 ratio). The rainfall in these three districts was measurably low which has practically affected the crop productivity. The GPS locations of each field was recorded for monitoring purpose and given in Annexure II. Altogether 121 crop cutting experiments (CCE) from representative fields were carried out along with district department of agriculture officials to record the pigeonpea yield. The CCE of both the practices (Local check and ICPH 2740) was carried out. The results are encouraging despite having long drought during important crop growth stages. The results revealed that average yield of ICPH 2740 under best management practices was higher in all the districts compared to local check. In Bidar, ICPH 2740 recorded yield of 1459 kg/ha which is 31% higher as compared to local check. Similar results were also noticed in Kalaburagi and Raichur. The average yield of 1875 kg was noticed in Kalaburagi and 1623 kg in Raichur which was 28 % and 39 % higher, respectively compared to local check. The comparison of the yield data across the district is presented in below fig (11).



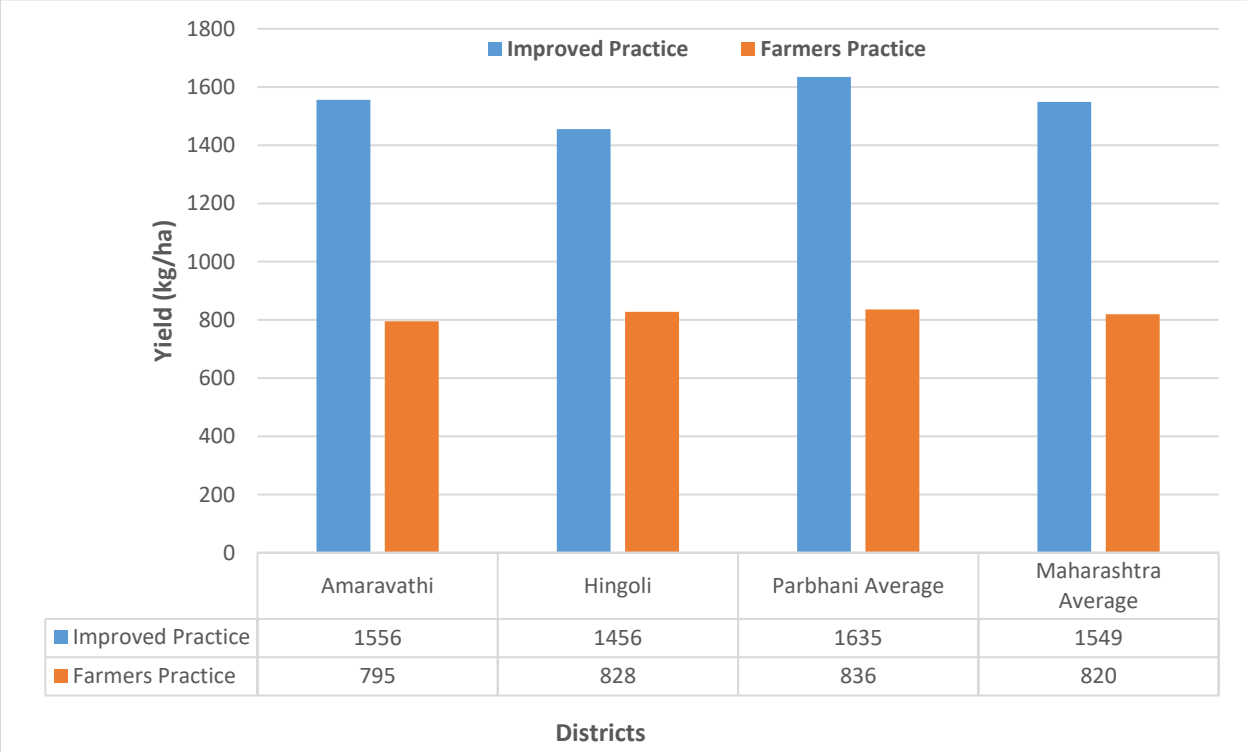
	Bidar	Gulbarga	Raichur	Karnataka Average
Improved Practice	1459	1179	1889	1509
Farmers Practice	948	826	1297	1024

Fig 11. Comparison of yield advantage with ICPH 2740 compared to local best varieties in different districts of Karnataka.

10.2 Maharashtra

During 2017-18, pigeonpea field demonstrations were conducted in 15 ha area in a participatory mode and choice of intercropping it with soybean was also encouraged. The crop realized yield of 24 q/ha with ICPH 2740 whereas popular variety BDN709 recorded 17 q/ha yield thereby showcasing yield advantage of 41 per cent with the earlier one.

During 2018-19, the NFSM pigeonpea project was implemented in three districts of Maharashtra viz, Amaravathi, Parbhani and Hingoli and the details of demonstrations are given in Annexure II. Pigeonpea was taken along with soybean in intercropping system with 2:6-8 ratio. As rainfall was not sufficient particularly during early crop growth stages, only 850 field demonstrations were successful as against target of 1500 ha. The sever drought period throughout the crop duration has also influenced crop productivity drastically. IN all 108 crop cutting experiments (CCE) were conducted across three districts to record crop yield. The CCE of both the practices (Local check and ICPH 2740) was carried out and average of all the CCE yield data is used for yield comparison. The results revealed that average yield of ICPH 2740 with improved practices were higher in all the districts compared to local check. In Amaravathi, ICPH 2740 recorded highest of 2350 kg/ha crop yield with average yield of 1556 kg/ha as compared to 795 kg/ha, recording yield advantage of 96% compared to local check. In Parabhani and Hingoli, ICPH 2740 recorded 1635 and 1456 kg/ha crop yield respectively which was 96% and 76% higher, respectively than local check Fig 12.



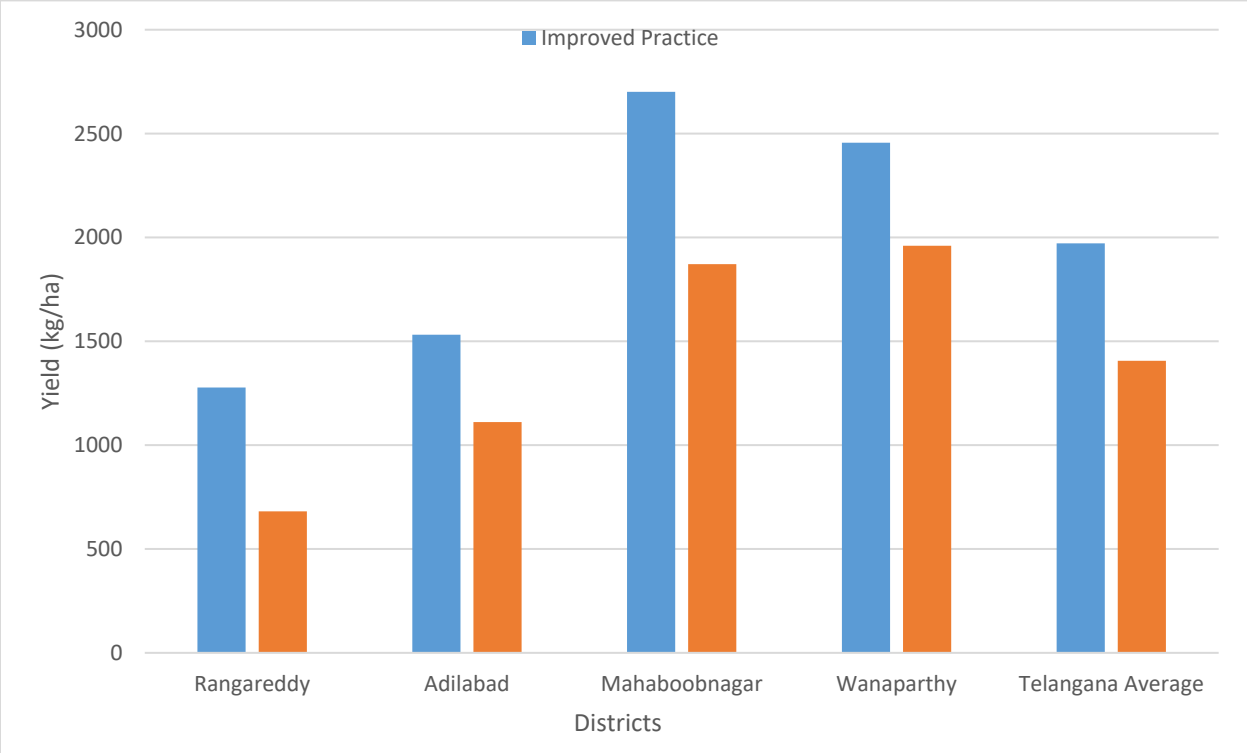
	Amaravathi	Hingoli	Parbhani Average	Maharashtra Average
Improved Practice	1556	1456	1635	1549
Farmers Practice	795	828	836	820

Fig 12. District-wise yield data of ICPH 2740 and local varieties in Maharashtra.

10.3 Telangana

In Telangana, NFSM project was implemented in Rangareddy, Adilabad, Mahaboobnagar and Wanaparthy district. The farmers details of each demonstration is given in Annexure III with details of lat long dat. Wanaparthy, which is part of earlier Mahaboobnagar was added in the project to cover targeted area in Telangana. There were 1300 ha demonstrations on pigeonpea conducted basically taking pigeonpea as either main crop or intercrop with either cotton, soybean etc. The data of crop cutting experiments were recorded in 162 demos on random basis along with project staff, NGO partners and Agril department staffs. The yield data clearly show that hybrid pigeonpea ICPH 2740 with improved management practices recorded higher yield compared to local checks. There has been 25 % (in Wanaparthy) to 88 % (in Rangareddy) increase in pigeonpea productivity across project districts in Telangana as compared to local check (Fig 13).

Fig 13. District-wise yield data of ICPH 2740 and local varieties in Telangana.

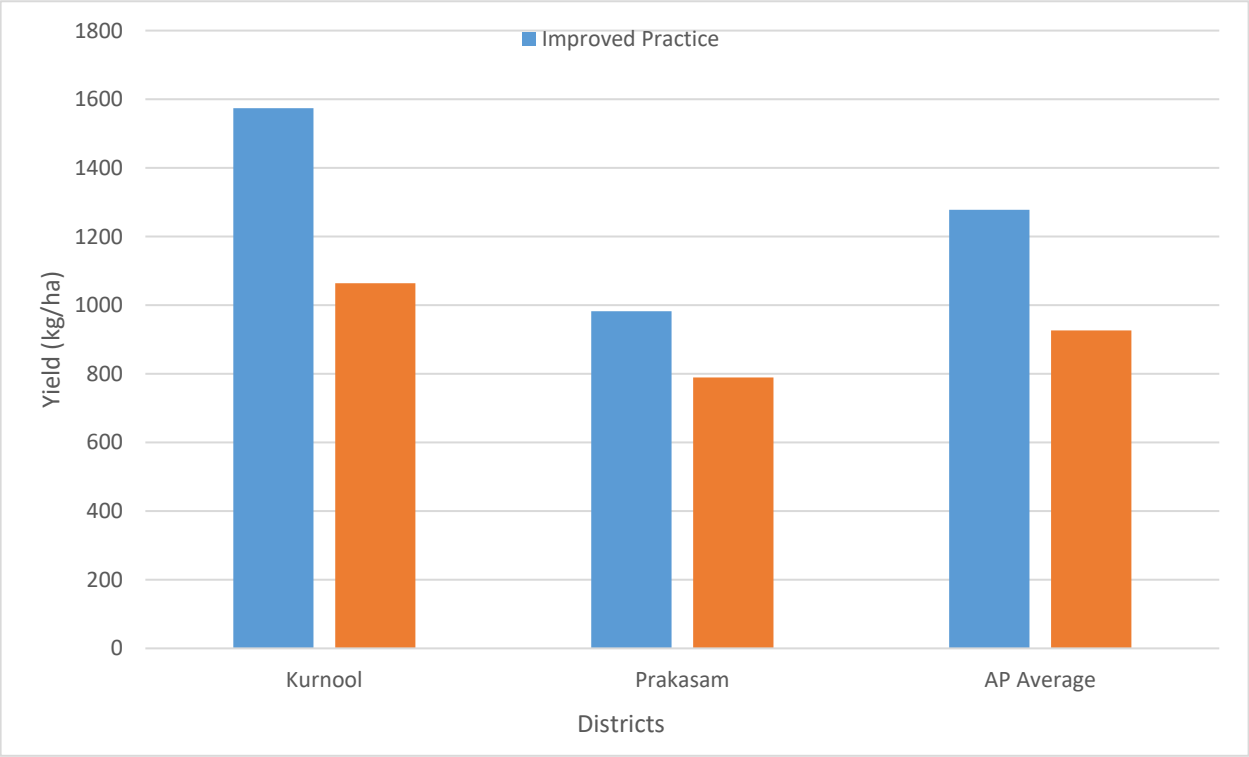


10.4 Andhra Pradesh

In Andhra Pradesh field demonstrations on pigeonpea were undertaken in Prakasam and Kurnool districts. Due to certain logistic issues the project could not carried out in Guntur district. The farmers details along with lat long data of two districts in Andhra Pradesh is provided in Annexure III. Pigeonpea was primarily grown as sole crop in both the districts whereas there were few demonstrations with intercropping system with soybean, cotton etc. Within these two districts, 87 CCEs were conducted for improved management practices with equal number of CCEs for farmers practices. The yield data of ICPH 2740 and local check was recorded in the both the districts and the data represents that there was 48% and 24% yield increase in Kurnool and

Prakasam districts, respectively over local check. The ICPH 2740 recorded highest yield of 2050 kg/ha and 1280 kg/ha in Kurnool and Prakasam districts respectively whereas, local check recorded highest of 1700 and 1080 kg/ha yield in Kurnool and Prakasam districts, respectively (Fig 14).

Fig 14. District-wise yield data of ICPH 2740 and local varieties in Andhra Pradesh.



10.5 Odisha

In Odisha project was implemented in Kalahandi, Rayagada and Boudh districts covering 500 ha area in each of these districts. The farmers details and GPS locations of every field demos is given in Annexure II. The yield data of ICPH 2740 was recorded through 129 CCEs with improved management practices in comparison with local check. The average yield data of ICPH 2740 in Kalahandi was 1531 kg which was 30 % more compared to average yield of local varieties (1175). In Rayagada, ICPH 2740 recorded yield of 1480 kg/ha which was 15% higher over local check (1284As regards to Boudh district, ICPH2740 recorded 1094 kg/ha pigeonpea productivity in interropping system with greengram, maize etc which was 56% more as compared to local check (Fig 15).

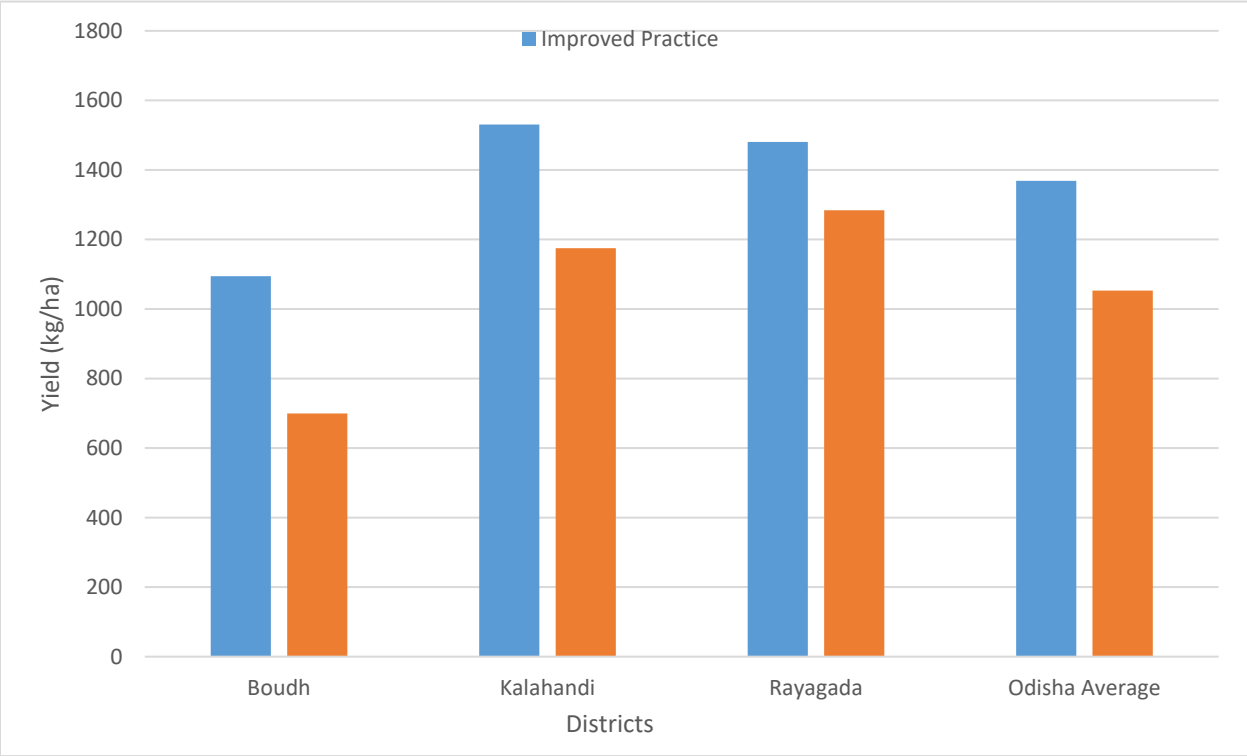


Fig 15. District-wise yield data of ICPH 2740 and local varieties in Odisha.

10.6 Pooled data comparison across project locations

The project was successfully implemented across 5 states covering 6002 field demonstrations with pigeonpea hybrid along with best bet practices. Overall, 615 CCEs were conducted and yield data across project locations (state wise) is presented in Table XX. The CCE data at district level covering field demonstrations was averaged to compute state-wise mean and comparison was made with local check. From the Fig 16, it can be revealed that maximum yield of 3750 kg/ha was recorded in Mahaboobnagar district in Telangana followed by Karnataka (1746 kg/ha), Odisha (1633 kg/ha), Maharashtra (1549 kg/ha) and Andhra Pradesh (1278 kg/ha). There are many factors contributed to higher yields in Telangana such as timely rainfall, depth and texture of soil, availability of assured irrigation facility etc, however, the scope for improvement remains at large.

Table 4: Yield comparison of pigeonpea demonstrations across project states during 2018-19			
District	**Improved Practice**	**Farmers Practice**	**% Increase**
Andhra Pradesh	1278	927	38
Maharashtra	1549	820	89
Odisha	1633	1287	27
Karnataka	1746	1322	32
Telangana	1971	1406	40

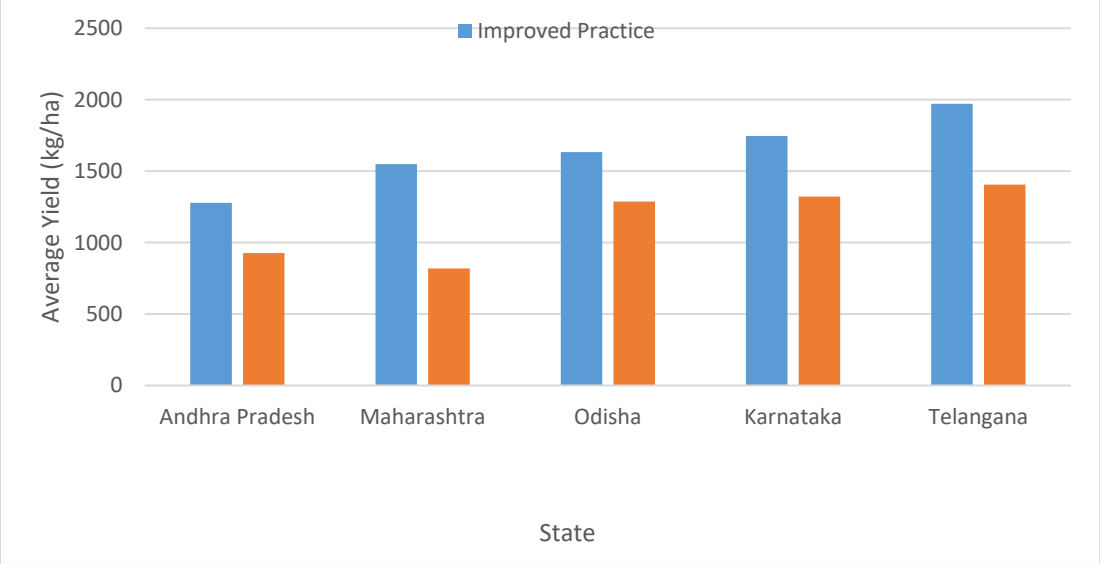


Fig 15. State-wise yield data of ICPH 2740 and local varieties.

Annexure II:

Packages Practices for pigeonpea hybrids under NFSM project

Ecology Soil requirements

Pigeonpea can be grown on a wide range of soil textures, from medium to heavy black clays but needs free-drainage. Pigeon pea prefers pH of 5–7, but can tolerate pH 4.5–8.4. Can handle some Al. Pigeon pea is sensitive to high salinity. Moisture as a crop, pigeon pea is very drought tolerant, able to grow with a dry season exceeding 6 months, and rainfall 35ºC when soil moisture and fertility are adequate, but generally grown in temperatures of 18–30ºC. It can grow at altitude but growth is slowed by low temperature. Leaf cannot tolerate frost but may escape a light ground frost due to its height. Light Prefers full sunlight but can tolerate some shading during the vegetative growth phase, which can result in etiolated stems. It is very sensitive to low radiation at pod development and requires full sunlight at this growth phase. Reproductive development Pigeonpea are day length sensitive requiring day lengths under 12.5 hr for flowering and seed production. However, many varieties have been developed with different responses to day length. Short varieties may start flowering only 60 days after planting while the taller woody species flower much later, from 180–250 days after planting.

Field preparation

Select well drained, disease free field/s with good drainage. Plough the field 2-3 times to a depth of 15-20 cm followed by 2-3 cross harrowing is recommended. Make furrows across the slope to avoid soil erosion and water logging. Ridge and furrow method or broad bed furrow method across the slope is recommended to conserve moisture and soil.

BBF can serve as good landform for pigeonpea as it helps in avoiding excess rainfall drained to side furrows whereas during low rainfall period, the furrows can do moisture storage. It is recommended to go for two plants per bed of 1-meter-wide and complete Broad bed furrow is of 1.5-meter width. Thus both the pigeonpea rows get the border effect due to more aeration and moisture due to this landform.

Recommended varieties

Recommended improved varieties of Pigeon Pea which are region specific and are in accordance with as soil type are to be selected for better performance and yield.

For AP, Telangana/ Maharashtra, Karnataka in Black soils under 1-2 assured irrigation: ICPH 2740 For Odisha under 1-2 assured irrigation: ICPH 3762

Seed Selection and seed rate

Select fresh, pure, healthy and good quality of seed from reliable source/s to obtain high germination percentage. Seed rate will be 5 kg/hectare.

Fertilizer Management

Pigeonpea respond very well to balanced nutrient management including secondary and micro nutrients. A basal dose of major nutrients viz, 20-25 kg N/ha, 40-50 kg P_2O_5/ha is recommended which can be met through application of 2 bags of DAP. For the soils deficient in potash, 40-50 kg K_2O/ha is recommended. Similarly, a basal dose of 100 kg Gypsum, 25 kg $ZnSO_4$ and 5 kg agribore is also recommended based on soil test analysis. It is also suggested to apply 12-15 tones FYM/ha once in two years.

Seed Treatment

Treat the seed with Carbendazim + Thiram (1:1) @ 3g/kg seed for wilt and root rot, Metalaxyl @ 3g/kg seed for Phytophthora blight.

Seed is to be treated by bio-fungicide i.e. Trichoduma and Rhizobium culture for wilt management and better nodulation (nitrogen fixation); respectively

Sowing Time

On set of monsoon or up to 20th of July.

Spacing

Variety/hybrid	**Type of soil**	**Spacing**
PRG 176	Red soil	4 Ft/1Ft
LRG 52	Black Soil	5 Ft/ 1 Ft
ICPL 332 WR , Maruti	Black soil	6 FT/ 1 FT
ICPH 2740 & ICPH 3762	Black soil	6 Ft/2 Ft in medium soil with protected 1-2 irrigation 6 ft x 2.5 ft or 4 ft x 4 ft under drip system

Sowing method

Either by dibbling or by seed cum-ferti drill, sowing can be done but spacing and seed rate must be strictly adhered.

Thinning and Gap filling

The plant population need to be maintained strictly so as to avoid competition due to excessive population or less population. If required, gaps to be sown after 8 days of sowing at the blank hills.

Water Management

Pigeonpea respond well to irrigation management. It requires irrigation during flowering to grain filling stage and it need to be ensured to maintain soil moisture to optimum. Similarly, protective irrigation should be given during vegetative growth if there is prolonged dry spell after germination. Hybrids are required to provide with optimum soil moisture for expressing its full potential.

Weed Management

The crop plant grow very slowly during their early growth of 40-45 days and the crop suffers from a severe weed infestation which causes in drastic reduction in grain yield, Therefore, it is advisable to keep the field free from weeds and a weed free condition may be achieved by giving two hand weedings once about 25-30 days and another about 45-50 days after sowing of the crop.

Pre-emergence application of Pendimethalin (@ 2.5 Lt/ha up to 48 hours after sowing and post emergence application of Imazythapyre @ 700 ml/ha before 30 days after sowing. (with an additional hand weeding at 20-25 DAS**.** By using herbicides the field will be weed free upto 50 days of sowing and least damage to the crop take place. Other herbicides are Metalachlor, Oxadiazon and Pendimethalin @ 1.0 kg a.i./ha as a pre emergence.

Plant Protection

Helicoverpa and maruca	Apply 5% neem seed kernel extract with 400 L of spray fluid at 8-10 days interval 2-3 spray of mixture of 1 ml Robin blue® /L of spray fluid having NPV of 500 LE in the evening Application of Endosulfon 2ml/lt /Quinalphos 2 ml/lt/Acephate 2gms/lt in early stages of pest infestation. Application of Avaunt@1ml/lt or Tracer@0.4ml/lt for 3 to 5 instar larvae.
Phytophthora blight	Practice Seed Treatment followed by 2 foliar application of Ridomil MZ@3gL^{-1} at 15 days interval starting from 15 days after emergence
***Fusarium* wilt**	Practice seed treatment with Trichoderma @ 5gms/kg.
Sterility Mosaic	Select, resistant varieties. Practice seed treatment Foliar application of acaricide (e.g. Kalthane® or Morestan® @5ml/lt.
Harvesting and Threshing	Harvest the crop when it is 80% matured i.e. turned to brown color.
Seed Storage	Sun dry the seed till the moisture content is less than 8%; clean the seed and kept in gunny bags; fumigate the store with Aluminium Phosphide (30 g celphos t^{-1} seed or 7-10 tablets of celphos 28-m^{-3}) periodically