Asian Journal of Agricultural Extension, Economics & Sociology

38(10): 167-177, 2020; Article no.AJAEES.60791
ISSN: 2320-7027

Precision Farming Development Centre Hyderabad: The Boon for Local Farmers

M. Uma Devi[1], Ibrahim Kaleel[1*], K. Chaitanya[1], Deepika[1], B. Srinu[1], A. Krishna Chaitanya[1] and G. Swathi[1]

[1]Precision Farming Development Center, Water Technology Center, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author MUD and KC designed the study and monitored over all research trials carried out in PFDC Hyderabad. Author IK wrote the protocol, and wrote the first draft of the manuscript. Author Deepika managed the analyses of the study. Authors BS, AKC and GS managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2020/v38i1030442
Editor(s):
(1) Dr. Hasan Vural, Uludag University, Turkey.
(2) Dr. Ian McFarlane, University of Reading, UK.
Reviewers:
(1) Burhanuddin Daeng Pasiga, Hasanuddin University, Indonesia.
(2) Maria José Tavares Ranzani de Paiva, Fisheries Institute, Brazil.
Complete Peer review History: http://www.sdiarticle4.com/review-history/60791

Original Research Article

Received 28 July 2020
Accepted 05 October 2020
Published 14 November 2020

ABSTRACT

Precision farming is the technique of applying the right amount of input (fertilizer, pesticide, water etc.) at the right location at the right time to enhance production, decrease input and/or protect the environment, Site-Specific Crop Management (SSCM), Farming by-the-foot, Farming soils and not fields, Prescription farming, Environmentally-friendly farming & Information-based crop production. Thus, precision farming is an appealing concept and its principles quite naturally lead to the expectation that farming inputs can be used more effectively, with subsequent improvements in profits and environmentally less burdensome production. The precision farming developments of today can provide the technology for the environment friendly agriculture of tomorrow. Especially in the case of small farmers in developing countries like India, precision farming holds the promise of substantial yield improvement with minimal external input use. In order to achieve optimal production with less inputs, Precision Farming Development Centre (PFDC), Hyderabad, Telangana, India, plays important role in Precision farming by reaching local farmers to introduce

**Corresponding author: E-mail: ibrahimkhaleel1075@gmail.com;*

precision farming techniques. PFDC Hyderabad attracts local farmers with tailor made annual action plans which includes both research and extension part. This study shows how PFDC Hyderabad uplifts both financial and social status of local farmers by introducing them to Precision Farming.

Keywords: Precision farming; precision agriculture; PFDC.

1. INTRODUCTION

Precision farming is not a new phenomenon anymore [1-3]. The agricultural sector is the mainstay of the rural Indian economy around which socio-economic privileges and deprivations revolve, and any change in its structure is likely to have a corresponding impact on the existing pattern of social equality [4,5]. The future growth in agriculture must come from new technologies which are not only cost-effective but also in conformity with natural climatic regime of the country; technologies relevant to rain-fed areas specifically; continued genetic improvements for better seeds and yields; data improvements for better research, better results, and sustainable planning; bridging the gap between knowledge and practice; and judicious land use resource surveys, efficient management practices and sustainable use of natural resources [6,7].

In Telangana the importance of Precision farming is increasing day by day due to shrinking land water resources and labor scarcity [8]. Farmers are cultivating the crops namely, Orchards, Vegetables, Flowers and Field crops etc. with the Micro Irrigation (Drip and Sprinkler) technology due to heavy scarcity of water. On the other hand, farmers are not able to control the weeds even under micro irrigation due to shortage of labor [9-11]. Further it is resulting in exhausting of water and nutrients around the plant due to crop weed competition, hence resulting in poor yield of crop. In view of the problems mentioned above, now the farmers of Telangana are showing much interest in adoption of the Precision farming technologies like drip and sprinkler irrigation, protected cultivation including plastic mulching, greenhouse, low tunnels and shade net house cultivations for getting high quality produce with maximum yields with the available limited water [12,13].

2. METHODOLOGY

Technology plays an important role in the rapid economic growth and social transformation in developing countries like India. By seeing the requirements of farmers and essentialities, in order to reach advanced precision technologies to local farmers in India the GoI started Precision Farming Development Centres (PFDC) under National Committee on Plasticulture Application in Horticulture (NCPAH), Govt. of India. National Committee on Plasticulture Applications in Horticulture (NCPAH) is constituted in the Ministry of Agriculture (MOA), Govt. of India to focus in a coordinated manner to popularize adoption of various plasticulture applications in horticulture & over all development of plasticulture applications in the country. Precision Farming Development Centres (PFDCs) been established in India to promote "Precision Farming & Plasticulture Applications for hi-tech horticulture" and located in State Agricultural Universities (SAUs); ICAR Institutes such as IARI, New Delhi; CIAE, Bhopal & CISH, Lucknow, PJTSAU, Hyderabad and IIT, Kharagpur. Presently 22 PFDC have been operating to promote various plasticulture applications in horticulture by undertaking Trials, Demonstrations in state focused crops, Workshops / Seminar, Transfer of Technology through training & awareness programmes, use of Radio / TV programmes, Publications etc in different agriculture climate zones of the country [14]. PFDC Hyderabad includes six major components which is carried throughout the year is as follows.

2.1 Skill Development Programme

Under this component one month (200 hrs) skill development programme is organized for local farmers, unemployed youths on precision farming technologies as per Qualifications Pack (QP) of Agriculture Skill Council of India (ASCI). Under this QP, models includes like Greenhouse Fitter, Greenhouse Operator, Irrigation Service Technician & Micro Irrigation Technician etc.

2.2 Impact & Value Chain Study

In this component network of facilities and distribution options of various crops were studied. The chain of activities gives the product more added value than the sum of added values of all activities. The ultimate goal is to maximize value creation and minimizing cost. It increases the customer satisfaction and manages the cost more effective.

2.3 Technology Demonstration & Transfer

Under this component

a. Small trainings were carried out to farmers as capacity building and hand holding to farmers at 25 Person/batch/day.
b. Demonstrations at PFDC farms and Technology Demonstration & Information Centre (TDIC) were carried out on various crops under precision farming technologies like use of plastic mulch sheets, protected cultivation, adopting micro irrigation systems, fertigation systems etc over conventional method.
c. Participation in Agri events like Krishi Melas, National and International conferences, seminars and symposiums etc, across the country.
d. Literatures & publications of various precision farming technologies carried out in PFDC.
e. Others Activities such as survey, radio & TV Talk, Print media, etc.

2.4 Technology Refinement

This is the major component which is focused for research of various precision farming techniques like Optimization of N P K fertigation levels for various agricultural and horticultural crops under different irrigation levels with and without mulch under different climatic conditions like open filed, shadenet and polyhouses. Performance of various vegetable crops to irrigation and NPK fertigation levels under different climatic conditions etc. These precision farming techniques were carried out under ongoing and new trials at PFDC farms.

2.5 Human Resource Development (HRD)

Staff Exposure Orientation programmes & travelling for PFDC staff.

2.6 Manpower Deployment

Under this component well qualified and experienced candidates were hired to run the PFDC.

3. RESULTS

3.1 Skill Development Programme

PFDC Hyderabad has conducted one month skill development programme (200 hrs) for farmers/rural youth on “Greenhouse operator” in collaboration with ASCI (Fig. 1), during 1st February to 8th march, 2018 at Water Technology Centre, PJTSAU. 29 candidates (28 members from Agriculture Diploma and Agricultural Engineering and 2 farmers) participated in the training programme. The Training programme includes both theory and practical classes and field exposure visits in which 70 hrs theory and 130 hrs practical classes were covered.

3.2 Impact & Value Chain Study

The study on ‘value chain analysis of mango in Chittoor district of Andhra Pradesh, India, has been conducted during 2017 in different mandals of Chittoor district, Andhra Pradesh, India. In which the total mango sample farmers covered were 96, processors were 10, traders were 21, nursery units were 11. After analysing the area, production, marketing channels, processing units, constraints for value chain and PFDC Hyderabad arrived with actionable activities to be undertaken to further encourage and strengthen the mango value chain system in Chittoor district, Andhra Pradesh, India.

3.3 Technology Demonstration & Transfer

a. One day training programme (10 no’s) to farmers on “Plasticulture applications in Horticulture/Agriculture” with sub theme on 'protected cultivation of vegetables and flowers' was conducted by PFDC, WTC, PJTSAU, Hyderabad, India during January-2019 to the farmers across Telangana state, India.
b. Demonstrations in PFDC farm during *rabi* 2017-18, *Kharif* 2018 & *Rabi* 2018-19 were carried out on Watermelon, Cucumber, Bhendi, Maize, Cotton, soybean, red gram, tomato, brinjal, Bhendi and marigold with mulching (25 micron, black/silver dual colour) technology (Figs. 2 & 3). The obtained yield results were compared with without mulch. The mulching gives the best performance than non-mulching.
c. PFDC, Hyderabad participated in four Agri events like Krishi Melas, National and International conferences during the year 2018-19. Nearly 800 visitors were visited PFDC, Hyderabad stall (Fig. 4). At stall staff explains about various precision farming technologies like use of plastics in agriculture and horticulture and also

distributes templates showing precision farming technologies.

d. Around five popular articles were published in local journals during the year 2018-19. The published popular articles includes information regarding precision farming technologies.
e. Others Activities such as survey, radio & TV Talk, Print media, etc also conducted during the year 2018-19.

3.4 Technology Refinement

Three ongoing trials were carried out during *rabi* 2017-18 under different climatic conditions. The title of ongoing trials with results are as follows.

3.4.1 Optimization of N P K fertigation levels for tomato (Heemsohna) under different irrigation levels and with & without mulch in poly house (Fig. 5)

During *rabi* 2017-18, the highest fresh fruit yield (164.87 t ha^{-1}) (16.49 kg m^{-2}) was recorded by tomato (Heem Sohna) (sum of 17 pickings) with application of 100% recommended dose of fertilizers (150-60-80 kg N-P_2O_5-K_2O ha^{-1}) at $I_{0.8}$ irrigation level without any mulch followed by application of 100% Recommended Dose of Fertilizer (RDF) at $I_{0.6}$ irrigation level without mulch (157.96 t ha^{-1}, 15.80 kg m^{-2}). Response to mulch (25 microns, dual coloured, black and silver) was not noticed under poly house conditions.

Fig. 1. Hands on training Bed preparation carried out by trainees during practical classes

Fig. 2. Cotton with and without mulch, Demonstration plots, PFDC, Hyderabad

Fig. 3. Marigold with and without mulch, Demonstration plots, PFDC, Hyderabad

Fig. 4. PFDC, Hyderabad participated in Kisan Mela 2019 at KVK, CRIDA, Hayathnagar, Telangana, India, On 16-02-2019. Around 200 farmers, officials visited PFDC stall

3.4.2 Optimization of N P K fertigation levels for tomato (Heemsohna) under different irrigation levels with and without mulch in shade net condition (Fig. 6)

During *rabi* 2017-18, the highest fresh fruit yield (136.43 t ha^{-1}) (13.64 kg m^{-2}) was recorded by tomato (Heem Sohna) (sum of 17 pickings) with application of 125% recommended dose of fertilizers (187.5-75-100 kg N-P_2O_5-K_2O ha^{-1}) at $I_{0.6}$ irrigation level without any mulch which was closely followed by application of 125% RDF at $I_{0.8}$ irrigation level without mulch (136.13 t ha^{-1}, 13.61 kg m^{-2}) and the next best was found to be F_{100} $I_{0.8}$ M_0 (133.79 t ha^{-1}, 13.38 kg m^{-2}). Response to mulch (25 microns, dual coloured, black and silver) was not noticed under shadenet conditions.

3.4.3 Optimization of N P K fertigation levels for tomato (Heemsohna) under different irrigation levels with and without mulch in open field condition (Fig. 7)

During 2017-18,The highest fresh fruit yield (57.98 t ha^{-1}) (5.8 kg m^{-2}) was recorded by tomato (Heem Sohna) (sum of 11 pickings) with application of 80% recommended dose of fertilizers (120-48-64 kg N-P_2O_5-K_2O ha^{-1}) at $I_{0.6}$ irrigation level with mulch which was closely followed by application of 80% RDF at $I_{0.8}$ irrigation level with mulch (55.0 t ha^{-1}, 5.5 kg m^{-2}) and the next best was found to be F_{100} $I_{0.6}$ M_1 (49.48 t ha^{-1}, 4.95 kg m^{-2}). Response to mulch (25 microns, dual coloured, black and silver) was noticed under open field conditions. The research trial on tomato (Heemsohna) crop in open field condition revelled that, the total tomato (Heemsohna) yield under mulching (25 micron, black/silver dual colour) was 19.83% higher (57.98 t ha^{-1}) when compared to without mulch (46.48 t ha^{-1}).

3.5 Human Resource Development (HRD)

Under this component PFDC Hyderabad staff has exposure orientation programmes, staffs were given facility to attend trainings programmes across the country to enhance their knowledge in precision farming sector.

3.6 Manpower Deployment

PFDC, Hyderabad was maintained by one PI and one Co-PI, one Research Associate, two Senior Research Fellows and one Computer Operator.

Fig. 5. Tomato (HeemSohna) crop with and without mulch in poly house

Fig. 6. Tomato (HeemSohna) crop with and without mulch in shadenet

Fig. 7. Tomato (HeemSohna) crop with and without mulch in open field conditions

4. CONCLUSION

Precision farming development centre Hyderabad adopts new advanced technologies which makes agriculture easy and less risky and more engaging which will draw youngsters into the agriculture profession. Developing countries like India has more opportunities for farmers to identify better high yielding location specific crops and in fact a farmer who adopts precision farming technology turns in to a breeder cum technically sound cum skilled farmer to produce better and higher yielding varieties, in which PFDC Hyderabad gives required training and facility to local farmers in the area of precision farming to achieve their goals. It is also a good way to ensure India's food security. As we know that agriculture is a backbone of the country were wealth and security of the country comes from its land and hence what is needed is sustainable, high-tech and high-productive agriculture which will be remunerative and provide both food and security for the country. The government of India can open more precision farming development centres with financial support in order to reach precision farming technology to every farmers and also can facilitate in this process by giving soft loans to the industry so that they get encouraged and engaged themselves in agriculture and precision farming activities. High-tech precision farming therefore can help in bringing next green revolution in India and can produce tremendous rural wealth in a sustainable and environmentally sound way. In the light of today's urgent need, there should be an all-out effort to use new technological inputs to make the 'Green Revolution' as an 'Evergreen Revolution'. In this context precision agriculture will help in bringing in the next green revolution to Indian agriculture.

CONSENT

As per international standard or university standard guideline participant consent has been collected and preserved by the authors.

ACKNOWLEDGEMENTS

The authors appreciate National Committee on Plasticulture Applications in Horticulture (NCPAH), Ministry of Agriculture & Farmers Welfare (MoA & FW), Department of Agriculture, Cooperation & Farmers Welfare (DAC & FW), O/o Commissioner of Horticulture Department of Horticulture, Government of Telangana & Government of India (GoI) for funding PFDC Hyderabad project. The involvement of DAATT Centres of Telangana state & KVK's of PJTSAU, Hyderabad in Demonstrating precision farming techniques and arranging local farmers for training were highly recognized and appreciated. The Shiv Sai Kumar, computer operator, PFDC, Hyderabad is acknowledged and appreciated. The input of Research and Technical staff of Water Technology Center, PJTSAU, Hyderabad is highly recognized in this work too.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ibrahim K, Chaitanya K. Shadenet house in agriculture. Agrobios newsletter. 2019;XVII(06):60-61.
2. Ibrahim K, Rajitha G, Chaitanya K, Srinu B, Harish J, Venkatkiran RK. Shadenet house in agriculture. Agrobios newsletter. 2018;XVII(06):60-61.
3. Ji S, Unger PW. Soil water accumulation under different precipitation, potential evaporation and straw mulch conditions. Soil Sci. Soc. Am. J. 2001;65:442–448.
4. Singh RS, Sharma RR, Goyal RK. Interacting effects of planting time and mulching on Chandeler strawberry (*Fragaria x ananassa* Duch.). Sci. Hortic. 2007;111:344- 351.
5. Shanwad UK, Patil VC, Gowda H. Honne. Precision farming: Dreams and realities for Indian agriculture. Map India; 2004.
6. Rajitha G, Srinu B, Ibrahim K. Fertigation: More profit per drop, Agrobios newsletter. 2019;XVII(11):32-33.
7. Mondal P, Basu M. Adoption of precision agriculture technologies in India and in some developing countries: Scope, present status and strategies. Elsevier Science direct. Progress in Natural Science. 2009;19:659- 666.
8. Annual Progress Report. Precision Farming Development Centre, Hyderabad, Water Technology Center, Professor Jayashankar Telangana State Agricultural University Rajendranagar, Hyderabad. Sponsored by Ministry of Agriculture, Department of Agriculture and Co-operation Government of India, New Delhi; 2019.

9. Patel AH, Tandel YN. Use of plastics in horticulture production - Department of Fruit Science, ASPEE College of Horticulture & Forestry, Navsari Agricultural University, Navsari – 396450 *Assistant Professor, ACHF, NAU, Navsari, Indian Farmer. 2017;4(Special Issue III):108-112.
10. Harish J, Ibrahim K, Venkatkiran RK, Chaitanya K, Srinu B. Profile probe: Monitoring soil moisture with advance technology. Agrobios Newsletter. 2019;XVII(11):57-58.
11. Ibrahim K, Chaitanya K. Maintenance of micro-irrigation system. Agrobios newsletter. 2018; XVII(11):128-129.
12. Kaleel M, Uma Devi K, Chaitanya B. Srinu, Deepika. Role of precision farming development Center (PFDC) Hyderabad in Plasticulture. CJAST. 2020;39(28):87-96.
13. Kar G, Kumar A. Effects of irrigation and straw mulch on water use and tuber yield of potato in eastern India. J Agricult.l Water Manag. 2007;94(109):116-491.
14. National Committee on Plasticulture Applications in Horticulture (NCPAH), Ministry of Agriculture & Farmers Welfare (MoA & FW), Department of Agriculture, Cooperation & Farmers Welfare (DAC & FW), Government of India (GoI).

APPENDIX

Photo gallery of PFDC Hyderabad staff showing extension services

Fig. 8. Trainees of skill development programme with Dr. V Praveen Rao, Vice Chancellor, PJTSAU and Dr. M. Uma Devi, PI & Director, WTC, PFDC, PJTSAU, Hyderabad India

Fig. 9. Dr. M. Uma Devi, PI & Director, PFDC, Hyderabad, Telangana India. visited mango canning unit, Chittoor, AP, India, for impact & value chain analysis of mango in Chittoor district of Andhra Pradesh, India

Fig. 10. Dr. Ibrahim Kaleel, research Associate, PFDC, Hyderabad, Telangana, India, visited mango farmer field for impact & value chain analysis of mango in Chittoor district of Andhra Pradesh, India

Fig. 11. Dr. M. Uma Devi, Director & PI, PFDC, WTC, Hyderabad & Chaitanya, Scientist (Horti), Co-PI, PFDC, Hyderabad, giving letures on 'Application of plasticulture in Horticulture/Agriculture' - Protected cultivation of vegetables and flowers under technology transfer component to local farmers and line department officers

Fig. 12. K. Chaitanya, Scientist (Horti) & Co-PI, PFDC, WTC, PJTSAU, Hyderabad, giving TV Talk on "Drip & Sprinkler irrigation in horticulture crops" was telecasted in DD Yadagiri (Local Channel), under Raithunestham programme

Fig 13. Technology Demonstration & Information Centre (TDIC), PFDC, Hyderabad displaying prototype models and display on precision farming

Fig. 14. Dr. Ibrahim Kaleel, RA, PFDC, WTC, PJTSAU, Hyderabad PFDC, WTC, PJTSAU, Hyderabad explaining about Protected cultivation, mulching and micro irrigation system to local farmers.

Fig. 15. Farmers from different states across the country visits PFDC Hyderabad research and demonstration fields to gain practical knowledge on Precision Farming Techniques.

Fig. 16. Tomato & Capsicum plant and fruit NPK analysis & Water analysis in PFDC Laboratory, WTC, Hyderabad by Dr. Sreenu, SRF, Deepika, SRF & Dr. Ibrahim Kaleel, RA, PFDC, Hyderabad

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/60791