International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(7): 159-164
www.biochemjournal.com
Received: 11-05-2024
Accepted: 15-06-2024

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A study on knowledge and adoption status of integrated pest management practices in groundnut in Telangana state

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DOI: https://doi.org/10.33545/26174693.2024.v8.i7Sc.1501

Abstract
A study was carried out to find the knowledge and adoption status of farmers about Integrated Pest Management practices in Groundnut with 120 sample size in Telangana State. The study revealed that nearly half of the respondents had medium knowledge and about half of the respondents had medium level of adoption however, majority of farmers adopted the cultural practices such as summer deep ploughing, manual weeding, sanitation of fields and crop rotation. With regards to the practices through mechanical control reveals that majority of respondents had low level of adoption *viz*., use of yellow sticky traps/pheromone traps / light traps and destruction of alternative host plants, whereas a high majority of respondent were low level of adoption practices i.e., preparation of neem seed extraction, frequency of their spray, concentration of neem seed kernel extract and use of neem oil with regard to insecticides of plant origin control**.** Similarly, in case of biological control such as use of trichogramma sp., use of bio-pesticides, use of fungal and Bt formulations, while about majority of respondents were adopted insecticides to control major pests with regards to chemical control. The study further reveals that nine independent variables were included in the study, out of which five variables were found positively and significantly related with the adoption level of IPM in groundnut that all the independent variables with could explain 62.48 variation in the adoption level of IPM in groundnut. The possible reason for non-adoption of technology might be due to non-availability of yellow sticky traps and pheromone traps etc. in time, lack of knowledge regarding using and installation of pheromone & yellow sticky traps, unaware about bio agents and bio pesticides and unaware about soil drenching of chemical spray for control of soil and seed born diseases. The major suggestion expressed by the respondents were availability of IPM modules in nearby input shops, conducting more exposure visits and demonstrations to convince the benefit of various IPM modules and creating more awareness about soil drenching of chemical spray for control of soil born diseases in Groundnut.

Keywords: Integrated pest and diseases management, adoption and knowledge

Introduction
Groundnut *(Arachis hypogaea*) botanically belongs to family fabaceae. It is known as the 'king of oilseed' crops. Groundnut is also called as the wonder nut and poor man's cashew. It is one of the most important oilseed crop in the world containing 48-50% of oil and 26-28% of protein and is a rich source of dietary fiber, minerals and vitamins. As much 90 percent of the total edible oil production in the country comes from two oil seed crops namely groundnut and rapeseed mustard.

Groundnut is an important oilseed crop in India which occupies first position in terms of area and second position in terms of production after soyabean. China ranks first in groundnut production with 17.57 million tonnes followed by India 6.73 million tonnes, Nigeria 4.45 lakh tonnes, Sudan 2.83 million tonnes and United States of America 2.49 million tonnes accounting for 36.01, 13.79, 9.12, 5.80 and 5.11 percent of total world production of 48.80 million tonnes in 2019-20. According to the second advance estimates 2022-23, Government of India groundnut production is estimated at 85.82 lakh tonnes as compared to 84.34 lakh tonnes in 2021-22. (Source: www.agricoop.gov.in). According to the all India *rabi* crop coverage report, Government of India, as on 22nd February 2023, groundnut was sown in around 5.67 lakh hectares as compared to last year (5.23 lakh ha). Among the states, Karnataka stood first in area coverage with 1.65 lakh ha followed by Odisha (1.10 lakh ha),

Tamil Nadu (0.94 lakh ha), Telangana (0.93 lakh ha) and Andhra Pradesh (0.81 lakh ha). (Source: www.agricoop.gov.in).

In Telangana state the major groundnut area was observed in Nagarkurnool (104513 acres), Wanaparthy (21286 acres), Jogulamba Gadwal (11910 acres), Vikarabad (13,444 acres), Mahabubnagar (11035 acres), Narayanpet (6,989 acres) and erstwhile Karimnagar (1086 acres) districts during the year 2023-24. (Source: https://agri.telangana.gov.in>open_record_view- (Telangana state portal))

The low productivity of groundnut may be due to many factors. Among them integrated pest management (IPM) practices to control major pests by the farmers is one of the important limiting factor in boosting up the groundnut productivity. Therefore, there is an urgent need of increasing the productivity of oil seed crops in the country through adoption of recommended technology by the farmers, the present study was conducted with the following objectives:

1. To study the farmer's knowledge level and adoption status of the IPM pracrices in Groundnut
2. To determine the association between the socioeco-psychological characteristics of farmers in their adoption of integrated pest management practices
3. To analyse the reasons/constraints for non-adoption and discontinuous adoption.

The present investigation was conducted in Mahabubnagar and erstwhile Karimnagar districts of Telangana state during the year 2023-24 to study the Knowledge and adoption status of IPM practices in Groundnut. In recent times the farmers cultivating groundnut crop are facing the problems with more pest attack and reduced yields. In this regard the present study was taken up with the main objective of identifying and analysing the knowledge and adoption of IPM practices by the farmers and to recognize the constraints in adoption of the technology. The study was conducted in 2023-24 with a sample of 120 farmers across Mahabubnagar and erstwhile Karimnagar districts of Telangana state.

Materials and Methods

The study was conducted in Mahabubnagar and erstwhile Karimnagar districts of Telangana state during the year 2023-24. In recent times Groundnut crop affected by a severe attack of pest and diseases lead to lower yields. The two districts *i.e.*, Mahabubnagar and erstwhile Karimnagar districts were selected purposively as the investigators working in the district. Three mandals *viz.*, Midzil, Boothpur and Jadcherla of Mahabubnagar and Chigurumamidi, Ganneruvaram, Malyala mandals of erstwhile Karimnagar district were purposively selected based on the cropped area and production under groundnut crop. From each mandal 04 villages were selected randomly and from each village 05 farmers who were growing groundnut crop since last five years were selected randomly thus making a total sample of 120. The data were collected through personal interview schedule. The procedure followed by Sen Gupta (1967) [1] was utilized to measure adoption level of the respondents. The Partial Adoption technique suggested by Supe (1973) [2] was followed with necessary modification for scoring the practices followed by respondents. Mean and standard deviation were used to categorization of respondents on the basis of low, medium and high category, correlation co-efficient was used to see the association and multiple regression was used to measure the effect of respondent variable towards the adoption level of IPM practices in Groundnut and results were interpreted accordingly.

Results and Discussion

The results obtained from the present investigation as well as relevant discussions have been summarized below

Table 1: Profile characteristics of the farmers n=120

S. No	Variables	Category	Frequency	Percentage
1	Age	Young (22-37)	28	23.33
		Middle (38-53)	56	46.67
		Old (54-69)	36	30.00
2	Education	Illiterate	4	3.33
		Primary school	44	36.66
		Upper school	8	6.67
		High school	52	43.33
		Intermediate	8	6.67
		Degree	2	1.67
		Post-graduation	2	1.67
3	Farm Size	Marginal(0-2.5)	40	33.33
		Small(2.5-5)	48	40.00
		Large(5& above)	32	26.67
4	Farming Experience	Low (0-7)	32	26.67
		Medium (8-14)	52	43.33
		High (15-21)	36	30.00
5	Training undergone	no training	68	56.67
		undergone training	52	43.33
6	Annual Income	Low (70,000-146667)	36	30.00
		Medium(146667-223333)	52	43.33
		High(223333-300000)	32	26.67
7	Extension Contact	Low (11-17)	28	23.33
		Medium (18-25	48	40.00
		High (26-33)	44	36.67
8	Socio political participation	Low (10-16)	36	30.00
		Medium (16-22)	52	43.33
		High (22-28)	32	26.67
9	Risk taking ability	Low (6-10)	40	33.33
		Medium (10-14)	48	40.00
		High (14-18)	32	26.67

It is evident from Table 1 that nearly 46.67 percent of the respondents selected were in the middle age group followed by old age (30.00%), 43.33 percent of the respondents were having high school level of education followed by primary school level (36.67%) of education. 40.00 percent of the respondents were having small farm size followed by marginal farm size (33.33%). 43.33 percent of the respondents were having medium farming experience followed by high (30.00%) farming experience. 56.67 percent of the respondents had received no training followed by undergone trainings (43.33%). 40.00 percent of the respondents were having medium level of extension contact followed by high level (36.67%) of extension contact. 43.33 percent of the respondents were having medium socio political participation followed by low (30.00%) socio political participation. 40.00 percent of the respondents were having medium risk taking ability followed by low (33.33%) risk taking ability. The results were conformity with those of Raja Madhu Shaker *et al* 2020 [3].

Table 2: Knowledge level of farmers on IPM in Groundnut disseminated by DAATTC, Mahabubnagar) n=120

S. No.	Technologies disseminated by DAATTC, Mahabubnagar	Respondents					
		Low		Medium		High	
		F	%	F	%	F	%
1	IPM in Groundnut	40	33.33	56	46.66	24	20.00

Distribution of respondents according to their knowledge level on IPM in Groundnut disseminated by DAATTC, Mahabubnagar.

Table 3: Extent of adoption of IPM in Groundnut disseminated by DAATTC, Mahabubnagar n=120

S. No.	Technologies disseminated by DAATTC Mahabubnagar	Respondents					
		NA		PA		CA	
		F	%	F	%	F	%
1	IPM in Groundnut	36	30.00	60	50.00	24	20.00

Distribution of respondents according to their extent of adoption of technologies disseminated by DAATTC, Mahabubnagar.

The data presented in Table 2 and 3 revealed that 46.66 percent of the respondents had medium level of knowledge and half of the respondents had partially adopted, Whereas 30.00 percent of them had not adopting, while 12.00 percent of the respondents had completely adopt the technology with regards to Integrated Pest Management Practices in Groundnut crop. The findings are conformity with those of Chandranna *et al*. (2009) [4]; Singh *et al*. (2012) [5-6]; Singh *et al*. (2014) [7] and Bagenia and Lakhera (2017) [8].

Table 4: Rank analysis of knowledge and adoption of IPM technology in Groundnut n=120

S. No	Particulars	Knowledge						Extent of adoption						M.S	Rank
		Yes		No		M.S	Rank	FA		PA		NA			
I	**Cultural practices**	F	%	F	%			F	%	F	%	F	%		
1	Deep summer ploughing	120	100	0	0.00	2.00	I	116	96.67	4	3.33	0	0.00	2.97	I
2	Sanitation of field	76	63.33	44	36.67	1.63	III	74	61.67	6	5.00	40	33.33	2.28	III
3	Crop rotation	94	78.33	6	5.00	1.62	IV	24	20.00	96	80.00	0	0.00	2.20	IV
4	Border crop with Bajra/Jowar/Maize and trap crop Castor 40-50 plants	10	8.33	110	91.66	1.08	IX	12	10.00	14	11.66	94	78.33	1.31	IX
5	Critical stages for protecting the crop from the pest	62	51.67	58	48.33	1.52	V	48	40.00	20	16.67	52	43.33	1.97	V
6	Dig the trench around the field to avoid the pest	50	41.67	70	58.33	1.42	VIII	40	33.33	8	6.67	72	60.00	1.73	VIII
7	Manual weeding	80	66.67	40	33.33	1.67	II	78	65.00	4	3.33	38	31.67	2.33	II
8	Field free from Parthenium weed	52	43.33	68	56.67	1.43	VII	40	33.33	24	20.00	56	46.67	1.87	VII
9	Time of sowing and plant spacing are important considerations. Where possible, there should be a clear break in time between successive groundnut crops (for control of early and late leaf spots)	28	46.67	32	53.33	1.47	VI	44	36.67	20	16.67	56	46.67	1.90	VI
II	**Mechanical practices**	F	%	F	%	M.S	Rank	F	%	F	%	F	%	M.S	Rank
10	Hand picking of egg masses/larvae/pupae	48	40.00	72	60.00	1.40	I	36	30.00	10	8.33	74	61.67	1.68	I
11	Destruction of alternate host plant	28	23.33	92	76.67	1.23	II	20	16.67	10	8.33	90	75.00	1.42	II
12	Setting up light traps	24	20.00	96	80.00	1.20	III	22	18.33	4	3.33	94	78.33	1.40	III
13	Using pheromone traps 4 to 5/acre (*Spodoptera*)	20	16.66	100	83.33	1.16	IV	18	15.00	6	5.00	96	80.00	1.35	IV
14	Yellow sticky traps 16 / acre	18	15.00	102	85.00	1.15	V	16	13.33	8	6.66	96	80.00	1.33	V
	Insecticide plant origin control														
15	Use of neem oil	40	33.33	80	66.67	1.33	I	28	23.33	10	8.33	82	68.33	1.55	I
16	Preparation of neem seed kernel extract	22	18.33	98	81.67	1.18	II	20	16.66	6	5.00	94	78.33	1.38	II
17	Concentration of neem seed kernel extract	40	33.33	80	66.67	1.33	I	28	23.33	10	8.33	82	68.33	1.55	I
18	Frequency of spraying of neem see extract	22	18.33	98	81.67	1.18	II	20	16.66	6	5.00	94	78.33	1.38	II
III	**Biological control**														
19	Use of Trichogramma sp.	16	13.33	104	86.66	1.13	IV	14	11.66	10	8.33	96	80.00	1.31	IV
20	Use of bio-pesticides	16	13.33	104	86.66	1.13	IV	14	11.66	10	8.33	96	80.00	1.31	IV
21	Whether the farmers identifies and their supplementary activity	48	40.00	72	60.00	1.40	I	36	30.00	10	8.33	74	61.67	1.68	I
22	Bt Formulation	28	23.33	92	76.67	1.23	II	20	16.67	10	8.33	90	75.00	1.42	II
23	Fungal formulations	22	18.33	98	81.67	1.18	III	20	16.66	6	5.00	94	78.33	1.38	III
IV	**Chemical control**														
24	seed treatment with bio-agents	10	8.33	110	91.66	1.08	VII	12	10.00	14	11.66	94	78.33	1.31	VII
25	Seed treatment with 2 ml Immidacloprid + 1gm Tebuconazole per kg seed	32	26.67	88	73.33	1.27	VI	24	20.00	12	10.00	84	70.00	1.50	VI
26	Insecticide applied to control major pest	94	78.33	26	21.67	1.78	I	80	66.67	16	13.33	24	20.00	2.47	I

27	Concentration/composition of pesticides	44	36.67	76	63.33	1.37	IV	28	23.33	14	11.67	78	65.00	1.58	IV
28	Frequency of application	64	53.33	56	46.67	1.53	III	62	51.67	14	11.67	44	36.67	2.15	III
29	Recommended dose of application	90	75.00	30	25.00	1.75	II	76	63.33	12	10.00	32	26.67	2.37	II
30	Precautions followed during spraying time	36	30.00	84	70.00	1.30	V	24	20.00	16	13.33	80	66.67	1.53	V
31	Soil drenching of chemical spray for control of seed and soil born disesases (color rot and stem rot)	8	6.66	112	93.33	1.06	VIII	10	8.33	16	13.33	94	78.33	1.30	VIII
32	Use of pesticides based on ETL	8	6.66	112	93.33	1.06	VIII	10	8.33	16	94	13.33	78.33	1.30	VIII

Further, the rank wise analysis of level of knowledge and adoption of respondents on various IPM practices (Table 4) infers that complete adoption of cultural practices such as deep summer ploughing has been perceived as first rank followed by manual weeding (II rank), sanitation of field (III rank) and crop rotation (IV rank). The results are quite obvious due to the fact these cultural practices part and partial of groundnut cultivation practices and generally known to the groundnut growers are regularly being practiced. The least preferred practices with regards to IPM practices through mechanical control methods were such as yellow sticky traps 16 / acre (V rank), using pheromone trap's (IV rank), setting up of light traps (III rank) and destruction of alternate host plants (II rank). The most preferred adopted practice was hand picking of egg masses/larvae/pupae (I rank). The possible reason may be due to the fact that lack of information on availability of pheromone trap and skill to use it, destruction of alternate host plants, light traps and its method of installation, including the difficulty in identification of larval stages and pupal stage. In case of insecticide on plant origin table also reveals that the least preferred adopted practices were preparation of neem seed kernel extraction (II rank) and frequency of spraying of neem seed extract (II rank). The probable reason might be due to the fact that groundnut farmers were not aware about the insecticide of plant origin. With regards to IPM practices through biological control table further reveals that the great the least preferred adopted practices were use of Trichogramma sp. (IV rank), use of bio-pesticides (IV rank), use of fungal formulation (Metarrhizium ansopliae and Beauveria bassiana) (III rank), Bt Formulation (II rank). The probable reason might be due to fact that complexity of these practices and non-availability of the said material. The table further indicated that IPM practices through chemical control evident that the most preferred and adopted practices were application of insecticides to control major pest followed by frequency of application and concentration/ composition of pesticide with I and II rank respectively. The probable reason for complete level of adoption of these specific chemical control practices by farmers might be that effective management of the pest within economic injury level. The other reasons that the farmers getting pesticides from the dealer on credit basis and repay after the sale of the produce. Similar results were observed by Sunderswamy and Bavalatti (1991); Chandranna *et al.* (2009) [4]; Singh *et al.* (2012 a&b) [5-6] and Bagenia and Lakhera (2017) [8]. The least preferred adopted practices with regards to chemical control table were use of pesticides based on ETL (VIII rank), soil drenching of chemical spray for control of seed and soil born diseases (color rot and stem rot) (VIII rank) and seed treatment with bio agents (VII rank). The results were in conformity with Bagenia and Meena (2017) [9].

Table 5: Correlation coefficients of independent variables of groundnut farmers with their extent of adoption of IPM technologies

S. No	Independent variables	Correlation coefficients (r) with adoption level of IPM technology
1	Age	0.068NS
2	Education	0.477**
3	Farm Size	0.142 NS
4	Farming Experience	0.257*
5	Training undergone	0.462**
6	Annual Income	0.134 NS
7	Extension Contact	0.349**
8	Socio Political Participation	0.240*
9	Risk taking ability	0.058 NS

To find out the relationship between the selected characteristics and adoption towards IPM technology, the analysis was done and results were given in Table-5. The finding indicated that out of nine independent variables, three variables i.e. education, training undergone and contact with extension agencies were found positively and highly significantly correlated at 0.01 percent level of significance, whereas farming experience and socio-political participation were found positively and significantly correlated at 0.05 percent level of significance, while other variables like age, farm size, annual income and risk taking ability showed statistically non-significant relationship with adoption towards IPM technology**.** Similar findings were also reported by Chandranna *et al.* (2009) [4]; Singh *et al.* (2012 a&b) [5-6]; Singh *et al.* (2014) [7] and Bagenia and Lakhera (2017) [8].

Table 6: Multiple regression analysis between adoption of IPM practices in Groundnut with Independent variables

S. No	Independent variables	Regression Coefficient "b" value	"t" value
1	Age	0.044	0.461
2	Education	1.519**	6.146
3	Farm Size	0.044	0.461
4	Farming Experience	0.329**	2.564
5	Training undergone	0.524*	1.982
6	Annual income	0.045	0.467
7	Extension contact	1.126**	4.511
8	Socio political participation	0.561*	1.200
9	Risk Taking Ability	0.038	0.368

Multiple regression analysis was carried out to predict the contribution of independent variables towards adoption of IPM practices and results were furnished in Table 6. The data reveals that three variables education, farming experience and contact with extension agencies showed highly significant and positive contribution towards adoption of IPM practices at 0.01 percent level of significance and only two variable i.e. training undergone

and social political participation showed significant and positive contribution towards adoption of IPM practices at 0.05 percent level of significance. The remaining four variables *viz*. Age, farm size, annual income and risk taking ability did not contribute significantly towards adoption of IPM practices. It is also seen that all the nine independent variables jointly contributed towards 62.48 percent of the variation in the level of adoption of IPM practices. The results were in conformity with the findings of Govind Prasad *et al* (2019) [10].

Table 7: Reasons for non-adoption of IPM practices n=120

S. No.	Category	F	%
1.	Lack of awareness on time of application and method of application	100	83.33
2.	Non-availability of yellow sticky traps and pheromone traps etc. in time	110	91.67
3.	Lack of knowledge regarding using and installation of pheromone & yellow sticky traps	106	88.33
4.	Lack of knowledge about technology	82	68.33
5.	Unaware about bioagents and bio pesticides	104	86.67
6.	Unaware about soil drenching of chemical spray for control of soil and seed born diseases.	102	85.00

It was revealed that (Table 7), the possible reason for non-adoption of technology might be due to non-availability of yellow sticky traps and pheromone traps etc. in time (91.67%), lack of knowledge regarding using and installation of pheromone & yellow sticky traps (88.33%), unaware about bioagents and bio pesticides (86.67%) and unaware about soil drenching of chemical spray for control of soil and seed born diseases (85.00%).

Table 8: Suggestions from respondents to improve their knowledge status and extent of adoption of IPM in Groundnut n=120

S. No	Category	F	%
1.	Provide disease resistant varieties through research stations/KVKs	106	88.33
2.	Conduct as many as group discussions, field days, exhibitions, kisan mela and exposure trip to groundnut growers to convince the benefit of various IPM modules	116	96.67
3.	Establish groundnut growers club and conduct regular meetings and focused group discussion (FGD) with scientist and progressive farmers.	108	90.00
4.	Create more awareness about soil drenching of chemical spray for control of soil born diseases in Groundnut	114	95.00
5.	To conduct more method demonstration on seed treatment with Rhizobium, PSB and Trichoderma.	112	93.33
6.	Availability of IPM modules in nearby input shops	118	98.33

Regarding suggestions (Table 8) for respondents to improve their knowledge status and extent of adoption of IPM in Groundnut were availability of IPM modules in nearby input shops (98.33%), conduct as many as group discussions, field days, exhibitions, kisan mela and exposure trip to groundnut growers to convince the benefit of various IPM modules (96.67%), create more awareness about soil drenching of chemical spray for control of soil born diseases in Groundnut (95.00%) and to conduct more method demonstration on seed treatment with Rhizobium, PSB and Trichoderma (93.33%) respectively.

Conclusion

It could be concluded that most of the respondents had partially adopted the IPM practices in groundnut cultivation. With reference to the extent of adoption IPM practices. Whereas, majority of the farmers were not adopted insecticide of plant origin and biological control practices. It appears that farmers were not fully aware about IPM practices. All these nine independent variables jointly explain significant amount of variation to the extent of 62.48 percent in adoption of IPM practices in groundnut. Thus it can be recommended that the respondents adoption must be updated about IPM practices in Groundnut. More specifically how to do aspect of specific technologies on biological control practices to increase the adoption of IPM practices among the respondents. It is to organize the training, discussion and group meeting, field days, field visit by considering the characteristics having significant relationship with adoption level. This will certainly help to increase the desired level of adoption of IPM practices in groundnut

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