ADOPTION OF INTEGRATED WEED MANAGEMENT PRACTICES BY SOYBEAN GROWERS

THESIS

Submitted to
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
In partial fulfillment of the requirements
For the Degree of

MASTER OF SCIENCE
IN
AGRICULTURE
(EXTENSION EDUCATION)

By
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Enrolment Number – RR-3365 **2021**

DECLARATION OF STUDENT

I hereby declare that the experimental work and its interpretation of the thesis entitled **"ADOPTION OF INTEGRATED WEED MANAGEMENT PRACTICES BY SOYBEAN GROWERS "** or part thereof has neither been submitted for any other degree or diploma of any University, nor the data have been derived from any thesis / publication of any University or Scientific Organization. The sources of material used and all assistance received during the course of investigation have been duly acknowledged.

Place: Akola.
Date: / /2021

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CERTIFICATE

This is to certify that the thesis entitled **"ADOPTION OF INTEGRATED WEED MANAGEMENT PRACTICES BY SOYBEAN GROWERS "**submitted in partial fulfillment of the requirements for the degree of "**Master of Science in Agriculture (Extension Education)"** of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola is a record of bonafide research work carried out by **MAHALINGE VISHAKHA RAJKUMAR** under my guidance and supervision.

The subject of thesis has been approved by the Student's Advisory Committee.

Place : Akola
Date :

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THESIS APPROVED BY THE STUDENT'S ADVISORY COMMITTEE INCLUDING EXTERNAL EXAMINER (AFTER VIVA–VOCE)

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Place: Akola. (**MAHALINGE VISHAKHA RAJKUMAR**)
Date: / / 2021 Enrolment No. RR-3365

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(A) List of Tables

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(D) Abbreviations

%	:	Per cent
^{o}C	:	Degree Celsius
/	:	Per
AO.	:	Agriculture Officer
Agr.	:	Agriculture
Agri.	:	Agriculture
ATMA	:	Agricultural Technology Management Agency
CAS	:	Career Advancement Scheme
DAS	:	Days after sowing
et al.	:	et alia (and associates)
etc.	:	Etcetera
Extn. Educ.	:	Extension Education
EDP	:	Entrepreneurial Development Programme
Fig.	:	Figure
Govt.	:	Government
ha.	:	Hectares
http	:	Hyper Text Transfer Protocol
IARI	:	Indian Agricultural Research Institute
i.e.	:	That is
Int.	:	International
IWM	:	Integrated Weed Management
J.	:	Journal
KVK	:	Krishi Vigyan Kendra

VNMKV	:	Marathwada Krishi Vidyapeeth
MPKV	:	Mahatma Phule Krishi Vidyapeeth
M. Sc.	:	Master of Science
NGO	:	Non-Government Organization
NSC	:	National Seed Corporation
PD	:	Project Director
PDKV	:	Dr. Panjabrao Deshmukh Krishi Vidyapeeth
Ph. D.	:	Doctor of Philosophy
Res.	:	Research
Rs.	:	Rupees
Sci.	:	Science
SD	:	Standard Deviation
SAU	:	State Agricultural University
SCA	:	State Certification Agency
Sq. km	:	Square kilometer
Std.	:	Standard
TAO.	:	Taluka Agriculture Officer
UAS	:	University of Agricultural Sciences
Unpub.	:	Unpublish
VNMKV	:	Vasantrao Naik Marathwada Krishi Vidyapeeth
www	:	World Wide Web
Yrs.	:	Years

(F) Thesis Abstract

a)	**Title of the thesis**	**:**	**ADOPTION OF INTEGRATED WEED MANAGEMENT PRACTICES BY SOYBEAN GROWERS**
b)	**Full name of student**	**:**	**MAHALINGE VISHAKHA RAJKUMAR**
c)	**Name and address of Major Advisor**	**:**	**Dr. U. R. CHINCHMALATPURE** Associate Professor Department of Extension Education Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) - 444104.
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i)	**Signature of the student**	**:**	
j)	**Signature, name and address of forwarding authority**	**:**	

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ABSTRACT

The present study “Adoption of Integrated Weed Management Practices by Soybean Growers” was under taken in Renapur and Shirur Anantpal talukas of Latur district in Marathwada region of Maharashtra State, Six Villages from Renapur and Shirur Anantpal talukas

of Latur district were selected randomly on the basis of maximum area under soybean crop for research study.

The exploratory research design was used for present study. The data from soybean growers were collected with the help of interview schedule.

The findings revealed that majority of respondents belonged to middle age group were educated up to high school level, middle family size (5 to 7), belonged to semi-medium size land holding category and agriculture Is the main occupation, with annual income between of Rs. 2,25,415 to Rs. 6,88,551/- had put up to 2.11 to 5.27 ha. area under soybean crop had medium sources of information, had medium category of extension contact had medium level of economic motivation, having medium level of innovativeness, had medium scientific orientation and had medium level of knowledge and adoption of integrated weed management practices.

In relational analysis it could be seen that, among selected variables education, occupation, source of information, extension contact, economic motivation, scientific orientation and knowledge was positively and significantly correlated with adoption at 0.01 level of probability. However the variables land holding, annual income, area under soybean crop and innovativeness was positive and significant with adoption of the respondents at 0.05 per cent level of significance. That means among all independent variables education, land holding, annual income, area under soybean crop, sources of information, extension contact, economic motivation, innovativeness, scientific orientation and knowledge were the most contributing variables for increasing adoption of respondents about integrated weed management practices use in soybean crop.

The constraints when studied and analyzed it is revealed that, the constraints like problem of higher cost of herbicides, load shedding and problem of wild animals respectively, it was followed by lack of technical guidance, inadequate supply of irrigation water in annual cropping system, inadequate supply of labour for hand weeding, lack of knowledge about use appropriate dose of herbicide, lack of proper information about

chemical weed control, problems regarding financial sources, rains after spray hampers the effect of herbicide and also observed that lack of knowledge and adoption about precautions taking while spraying was some of the major constraints faced by the respondents.

On the basis of these findings it is implies that extension functionaries should organize result demonstration for use of IWM practices in soybean crop. In this context it is also suggested that information regarding IWM practices use in soybean crop should be disseminated to the soybean growers by extension functionaries of State Department of Agriculture, NGO's and Agriculture Universities, through demonstration, trainings field visits, distribute the leaflets, printed materials and the other media of transfer of technology for imparting knowledge & increased adoption about integrated weed management practices.

CHAPTER I

INTRODUCTION

1.1 Background information

The soybean called as “Golden bean”, “Queen of pulse” or “Agriculture Cinderella”. It is a type of legume native to Southeast Asia and firstly domesticated by Chinese farmers around 1100 BC. In 1904, the famous American chemist George Washington Carver discovered that soybeans are valuable source of protein and oil.

India is the fourth largest oilseed producing country in the world. Soybean was introduced in India in 1960’s. It is introduced as an oilseed crop in India to increase edible oil resource in the country due to its high yield potential. Soybean is important cash crop mainly produced in Madhya Pradesh, Maharashtra, Rajasthan and Karnataka.

Soybean has attained great importance in Indian agriculture as a pulse and oilseed crop because of its nutritional and industrial value. The soybean in India occupies an important place as getting of more foreign exchange from the export of soya powder due to its greater demand in international market. It is also called a miracle of 20^{th} century.

It contains 40.00 per cent protein and 20.00 per cent cholesterol free oil. In addition, it also contain 21.00 per cent carbohydrates 11.5 per cent iron and 4 per cent minerals salt like calcium, phosphate and many important vitamins too. Soybean gives 2-3 times more protein in yield than other legumes and oilseed. Soybean also has capacity to ameliorate nutritional situation, enhance productivity of other crop and also protect the environment from allelopathy tendencies of agricultural chemicals.

The main factors related to decrease in soybean production is inadequate weed control. The weeds are always competing with crops by resources (water, light and nutrients). This competition is important mainly in the initial stages of crop development, due to possible losses in production that can be up to 80 per cent or even, in extreme cases, hinders harvest operations.

Along with revolution in agriculture came weeds, unwanted plants that prospered with same human created environment. Weeds are therefore just as much a part of our domestic culture as crops. So the history of weed control technology is co-existent with the history of agricultural technology. The earliest weed control technology that was introduced initially was hand pulling of weeds. Then this technique was replaced with machine drawn implements like cultivators, rotary weeders etc. Herbicides or use of chemical became the principle tool of weed control in most developed nations from 1940 onwards and are spread slowly in developing countries like India after 1970.

In soybean crop, weed control can be achieved by using one or more control methods that are: preventive, mechanical, chemical, biological and cultural. Farmers can also use the integrated weed management (IWM), in which two or more of these methods are adopted. Integrated Weed Management is defined as a system approach which brings all feasible method of weed control harmonizing them into single and coordinated system designed to maintain weed below those level at which they cause economic loss. This technique utilizes all suitable method in compatible manner as possible. It involves tactical use of multiple tools for weed management including combinations of herbicides, crop rotation, mechanical and biological control as well as other cultural practices designed to reduce damage by weeds.

Certain weeds are more competitive with soybean than others mainly because of differences in their growth habit. Therefore, for effective weed management in soybean, growers should concentrate their efforts on weed management in the early part of the growing season.

1.2 Area and production and productivity

Madhya Pradesh is first and Maharashtra is second largest soybean producing states in India. In Vidarbha region cotton is main crop for kharif season but, from last five years farmers prefer soybean crop because less input and high benefit returns. The production of soybean in India at present time is restricted mainly to Madhya Pradesh, Uttar Pradesh, Maharashtra and Rajasthan. It is also cultivated in small

proportion in Himachal Pradesh, Punjab and Delhi. The crop production rate in India is increasing day by day.

Table 1: Area, Production and productivity of soybean (2019-2020)

Particulars	Area (Lakh ha.)	Production (Lakh ton.)	Productivity (Kg/ha)
India	113.98	135.05	836
Maharashtra	36.390	36.295	971
Marathwada	5.650	1.489	11.26
Latur	1.489	1.75	11.00

(Source: Statistics by SOPA, Indore, Madhya Pradesh 2019 and major oilseed report by VNMKV, Parbhani.)

1.3 Objectives of the study

1. To study the personal, socio-economic, communication, situational and psychological characteristics of the soybean growers
2. To study the Knowledge about recommended Integrated Weed Management practices
3. To study adoption of Integrated Weed Management practices by soybean growers
4. To find out the relationship of selected characteristics of soybean growers with adoption of Integrated Weed Management practices
5. To study the constraints faced by soybean growers in adoption of Integrated Weed Management practices

1.4 Recommended integrated weed management practices in soybean

The recommended integrated weed management practices to be followed by the soybean growers are such as preventive control, mechanical control (weeding, hoeing) and chemical control (herbicide).

1.5 Losses caused by weeds

Presence of weeds in an around agricultural land causes enormous losses which may be borne by us. About one third of potential food production in India is lost due to insect, weed, disease etc. Among all

pest in India weeds alone are responsible for about one third loss in crop production (Kulshreshta and Parmar, 1992).

It has been estimated that weeds alone caused 5 per cent loss in agricultural production in most developing countries. It caused 10 per cent loss in developing countries (Bhowmik, 1998). An analysis revealed that losses caused by weeds in India were to the tune of 9.28 million tons in cereals, 0.57 million tons in oilseeds, 0.78 million tons in pulses and 7.2 million tons in fiber and other commercial crops (Sahoo and Saraswat, 1998).

Soybean crop is infested by number of weeds like Shippi (*Echinochloa crusgalli*), Kena (*Commelina benghalensis*), Dudhi (*Euphorbia hirta*), Hazardani (Phyllanthus niruri), Nagarmotha (*Cyperus rotundus*), Hariyali (*Cynodon dactylon*) which cause loss up to 40-60 per cent in yield.

1.6 Need and importance of the study

Being most important oilseed crop in the world, cultivated over large area soybean is the most problematic crop of the world attacked by number of weeds, insects, pest and diseases. Weed not only decreases the soybean production but also deteriorate the quality as well as harbor insect's pest and disease. Manual weed control is difficult and costly because of unavailability of labours and high cost of labour during the peak period of intercultural operations. Based on national research to overcome loss caused by weed use of IWM in soybean crop has been emerge. The use of silent IWM technologies like herbicide application is the most economical way of controlling weeds.

The study would be helpful to administrator, policy maker, agricultural scientists and extension agencies. This study would also be useful to know constraints faced by the farmers while using IWM practices in soybean crop. The use of IWM practices provides better control, thereby reduce crop weed competition. The use of IWM practices is most economic and easy way of controlling weeds. It increases yield up to 30 per cent in soybean crop.

1.7 Hypothesis

Keeping the objectives of study in view, the following research hypotheses were framed as the different aspect of the study. While formulating the hypotheses, the nature of relationship between the variables was determined on the basis of review of literature. The hypotheses are set up are presented in null form (Ho) as follows.

1. Ho: There is no significant relationship between the selected personal, socio-economic, situational, communication and psychological characteristics of the soybean growers with their adoption of IWM practices.

1.8 Scope of study

The present study is designed as indicated in the objectives earlier, to study the profile characteristics of IWM practicing soybean growers. The investigation also deals with the adoption of soybean growers with respect to the IWM practices in crop production the investigation also deals with the problems faced by the soybean growers in adoption of IWM practices and suggestions to overcome them. The may prove useful to extension workers in identifying management practices and those who not availing IWM practices. Similarly the study attempts to understand the factors promoting and retarding the knowledge and adoption of IWM practices followed by soybean growers.

1.9 Limitations of study

Since all the social science is subjected to certain limitations, the present study is no exception. As such, the study adds certain limitations indicated below.

1. The findings of the study may have limitations of time and resources available for single investigator due to epidemic outbreak.
2 Since the study will be based on individual perception and expression of the respondents, some degree of error may be possible in the data due to lack of accurate expression of the respondents.

3. The study being student research project, time money and other resources did not permit to cover larger area than the one selected for the purpose of study.

1.10 Organization of thesis

I. The present study is presented in five sections each designated as chapter.

II. In the first chapter, the statement of the problem under study has been introduced. The importance of study, the specific objectives, scope and limitations of the study have also been introduced.

III. The second chapter namely review of literature comprises of review of relevant literature and findings of previous research studies conducted in different locations.

IV. The third chapter methodology includes research methods, techniques, tools used and procedures following.

V. The fourth chapter along with the findings of the present study along with the discussion there upon.

VI. The fifth chapter contains a brief summary and conclusion of the study.

VII. The sixth chapter contains implication for extension and for further future research.

VIII. Finally literature cited appendices and vita at end of thesis.

CHAPTER II

REVIEW OF LITERATURE

The review of past literature makes the researchers aware about the methods, procedures and techniques available and used, as well as the outcomes and conclusions of the past studies. It provides guidance about the research process. Attempts have been made to gather findings having relevance with the topic under study. The review of literature so collected is presented in this chapter.

Part I: Personal, socio-economic, situational, communication and psychological profile of the respondents.

2.1 Independent variables

The set of independent variables in the present study included personal, socio-economic, communication, situational and psychological characteristics of the farmers. The review of past studies pertaining to these variables is presented below.

2.1.1 Age

Sangeetha *et al.* (2009) reported that majority of the cotton farmers were middle aged (35.00%) fallowed by young and middle age group.

Savant (2011) observed that majority of 55 per cent respondents were in middle age group and showed that there was negatively significant relationship between age and level of knowledge and adoption of weed management practices by cotton growers.

Ashish Kumar (2012) reported that majority of respondents 36.00 per cent were belong to middle age group of 36 to 50 years, followed by 33.33 per cent appeared in young age group of up to 35 years while, 30.6 per cent of the respondents were observed in old age category i.e. above 50 years.

Mohite (2013) observed that majority of respondents were belonged to middle age group of 36 to 50 years and showed that there was

positive but non-significant relationship between age and knowledge and adoption of bio fertilizer by soybean farmers.

Deogirkar (2014) observed that over half of the 53.33 per cent of respondents were belonged to middle age group category having age between 36 to 50 years. It was followed by 30.00 per cent respondents were belonged to old age category i.e. Above 50 years and remaining 16.67 per cent respondents were observed in young age category i.e. up to 35 years. Thus, it was concluded that, majority of respondents were belonged to middle age group category.

Barkade (2015) reported that nearly half of the respondents (48.00%) belonged to middle age group category having age between 36 to 50 years. It was followed by (27.33%) of the respondents who belonged to young age category i. e. up to 35 years and remaining (24.67%) of the respondents were observed to be in old age category i.e. above 51 years. Thus, it was concluded that, half of the respondents were in the category of middle age group.

Hingne (2016) in his study reported that near about half of the 45.00 per cent respondent were belonged to middle age category having age 36 to 50 years, followed by 30.00 per cent respondent were young age category i.e. up to 35 years and remaining 25 per cent respondent were belonged to old age category i.e. above 50 years.

Sikarwar, Rahul Singh (2019) reported that majority of respondent (64.17%) belonged to middle age group while, (29.16%) belonged to old age group (6.67%) respondent were belonged to young age group.

Ramesh Chand *et al.* (2019) reported that majority 70.42 per cent of the farmers were of middle age followed by old 21.42 per cent.

Anuradha Ranjan Kumari *et al.* (2020) respondents selected maximum 58.88 per cent were of age group 35 – 55 years followed by respondents 22.77 per cent of above 55 years of age and only 18.33 per cent were of age less than 35 years.

Jatesh Kathpalia *et al.* (2020) reported that majority of the respondents (53.75%) were belonging to middle age group followed by a young age group (28.75%).

2.1.2 Education

Savant (2011) observed that education had significant relationship with level of knowledge and adoption of weed management practices by cotton grower.

Ashish Kumar (2012) reported that majority of respondents were educated up to high school level which was followed by primary level education (22.00%) and (21.33%) respondents educated up to college level and above college level. While, (18.67%) of respondents were having middle school level education and (6.00%) were illiterate.

Kale *et al.* (2014) observed that more than one third of 35.83 per cent soybean farmers were educated up to high school level followed by 26.68 per cent had higher secondary school education.

Deogirkar (2014) observed that, more than one third 38.33 per cent of the respondents were educated up to high school level education, 32.50 per cent respondents were educated up to higher secondary school.

Barkade (2015) reported that, over one third of the respondents 40.0 per cent were educated up to college level education, 31.33 per cent respondents were educated up to high school level followed by middle school 12.67 per cent, primary school 10.67 per cent, However it was also observed that, 5.33 per cent respondents were illiterates who have not attended any formal schooling.

Hingne (2016) in his study reported that higher proportion of respondent 38.00 per cent were found to be educated up to high school level education, 29.00 per cent respondent were educated up to college level, followed by 17.00 per cent middle school level and 13.00 per cent respondent were doing to be educated up to primary school level respectively.

Sikarwar, Rahul Singh (2019) reported that maximum number of respondent 38.33 per cent possessed middle school education, followed by primary education 22.5 per cent, literate 15.83 per cent, high school 14.17 per cent and above high school 9.17 per cent respectively.

Ramesh Chand *et al.* (2019) reported that majority of the farmers were literate (86.33%). A little above one-fourth of the farmers were educated up to matric (24.58 %) followed by middle and intermediate (17.50%), illiterate (16.67%), graduate (8.75%) and post graduate (1.25%).

Jatesh Kathpalia *et al.* (2020) education, 50 per cent of the respondents were educated at secondary school level.

Anuradha Ranjan Kumari *et al.* (2020) more than half of the respondents educated up to high school followed by (21.11%) educated up to middle, (11.66%) higher secondary and above and only 3 to 10 per cent of respondents illiterate to primary level respectively.

2.1.3 Family size

Deshmukh *et al*. (2007) revealed that the per cent of the families between 1 to 5 members size group was highest in Vidarbha (71.70%), it is followed by 6 to 10 members family size group (25.00%). Among the Districts, in Buldhana it was highest (79.17%) families were categorized fewer than 1 to 5 members and in Wardha District it was (35.00%) families comes under 6 to 10 members family size.

Yesankar (2010) found that (68.89%) rural women respondents belonged to medium size family and (30.37%) belonged to large size family and (0.74%) belonged to size family.

Katole *et al.* (2015) revealed that majority of the respondents (48.00%) having 6 to 11 members in their family, followed by (32.67%) of them were having up to 5 members in their family and remaining (19.33%) having more than 11 members in their family.

Hingne (2016) reported that majority of (46.00%) of soybean growers had small family size, followed by (44.00%) of soybean growers belonged to medium family size (05 to 08 members), whereas (10.00%) belonged to large family size.

Jatesh Kathpalia *et al.* (2020) reported that most of the respondent was belonging to nuclear family type with up to 4 members are (65.00%) and joint family type with above 5 members is (35.00%).

Anuradha Ranjan Kumari *et al*. (2020) reported regarding family structure that 71.66 per cent were enjoyed with nuclear family and rest 28.33 per cent enjoyed with joint family.

2.1.4 Land holding

Nichal (2010) revealed that 54.17 per cent of the respondents were from medium size of land holding, 20.83 per cent from semi-medium size of land holding and followed by 19.17 per cent and 4.17 per cent of respondents from small and marginal land holding respectively, 1.66 per cent of respondents were belonged to big land holding.

Deshmukh *et al.* (2011) in his study entitled that 32.50 per cent of the respondents had small size land holding, 24.17 per cent had medium size land holding, 19.17 per cent had semi medium and 12.57 per cent were having big land holding, whereas 11.66 per cent were marginal land holders.

Ashish Kumar (2012) reported that 65.33 per cent of the respondents possessed medium size land holding followed by 24.00 per cent of the respondents had semi-medium size of land holding and he respondents in small and margin all and holding category both were 4.67 per cent and 3.33 per cent respectively. Later 2.67 per cent were having large size of land holding.

Kale *et al.* (2014) observed that majority of respondents 36.67 per cent belonged to semi-medium category of land holding followed by small and medium category of land holding.

Deogirkar (2015) than one third (35.83%) of the respondents had 1.01 to 2.00 ha. area under soybean followed by (30.00%) of respondents put up to 1.00 ha. area under soybean crop. Whereas, (24.17%) of the respondents put area between 2.01 to 4.00 ha. under soybean crop and only (10.00%) respondents put 4.01 to 10.00 ha. area

under soybean respectively. Thus, it is inferred from above that majority of (65.83%) respondents put up to 2.00 ha. area under soybean crop.

Hingne (2016) reported that majority of (39.00%) respondent were observed in semi medium category of land holding fallowed by (24.00%) were having land holding small category, whereas (17.00%) of respondent had land holding of medium category and (13.00%) respondent had land holding up to 1.00 ha. i.e. marginal category. Only (7.00%) respondent belonged to large land holding i.e. above 10.00 ha. land holding category.

Sikarwar, Rahul Singh (2019) reported that majority of respondent (59.17%) were marginal land holding (up to 1 ha.), whereas, (10.17%) had small size land holding (1.1 to 2 ha.), (17.5%) of them were medium size of land holding (2.1 to 5 ha.) and only (4.16%) were large size of land holding (above 5 ha.).

Ramesh Chand *et al.* (2019) reported that were (33.75%) large farmers followed by small (25.83%), medium (20.83%) and marginal (19.58%).

Jatesh Kathpalia *et al.* (2020) (60.00%) of the respondents were having medium land holding (10.01-25.00) followed by small land holding.

Anuradha Ranjan Kumari *et al.* (2020) revealed that more than half of the respondents (52.77%) possessed up to 1.1 to 2 ha. of land.

2.1.5 Occupation

Bhandare (2011) revealed that (65.83%) of the respondents had agriculture as a main occupation while (15.00%) of the respondents had agriculture + labour occupation followed by (10.83%) of the respondents had agriculture + subsidiary occupation, (5.83%) were engaged agriculture +service occupation, (2.50%) having agriculture + business as occupation.

Bhople *et al.* (2015) observed that farm labour is the main occupation of (57.00%) of the respondents, it was followed by (53.00%) of

respondents had farm labour and agriculture as the occupation and none of respondents had agriculture plus subsidiary occupation.

Sangeetha *et al.* (2009) reported that majority of the cotton farmers were having farming as main occupation (47.50%).

Mankar *et al.* (2015) observed that agriculture was the main occupation of (77.33%) of the respondents, followed by (13.50%) of respondents had agriculture plus labour occupation and respondents were engaged in agriculture plus service as their occupation (4.34%) and fewer per cent respondents had agriculture plus other business subsidiary occupation (2.83%) and agriculture plus subsidiary occupation (2.00%).

Bhaltilak (2017) observed that majority of the cotton growers 64.00 per cent had agriculture as main occupation, it was followed by (15.00%) cotton growers having agriculture and labour, (13.00%) cotton growers had agriculture plus allied occupation, (5.00%) cotton growers having agriculture plus business as an occupation and only (3.00%) growers had agriculture plus service as an occupation.

Patel and Mazhar (2019) reported that the majority (63.33%) respondent was having farming as their major occupation fallowed by (21.63%) farming and service and (15.00%) were farming and business.

Sikarwar, Rahul Singh (2019) reported that the most of the respondent (43.33%) belonged to agriculture as their occupation fallowed by agriculture + animal husbandry (38.33%), agriculture + service (10.00%), agriculture + service +business (6.67%), agriculture + service + business + other (1.67%) respectively.

2.1.6 Annual income

Deogirkar (2014) observed that, majority of 44.17 per cent of the respondents were having annual income between Rs. 75,001 to 1, 50,000/- this was followed by 33.33 per cent of the respondents were having to annual income Rs. Up to 75,000/- and 11.67 per cent of respondents have annual income between Rs. 1,50,001 to 2,25,000/-. whereas, 8.33 per cent farmers had annual income between 2, 25,001 to 3,

00,000/- and only 2.50 per cent of respondents had annual income above 3, 00,001/-.

Machhar *et al.* (2015) revealed that (56.00%) soybean growers were having annual income between 31,000 to 50,000 followed by 50,000 to 70,000 and 70,000 and above annual income with (27.33%) and (11.33%) respectively. Remaining 4.67 and 0.67 per cent soybean growers were found 20,000 to 30,000 and less than 20,000 annual incomes, respectively.

Hingne (2016) reported that respondent in higher proportion (35.00%) had annual income between Rs. 50,001 to 1,00,000/-, followed by (23.00%) respondent had annual income Rs. 1,00,001 to 1,50,000/-. This was followed by (19.00%) respondent had annual income above Rs. 1,50,001 to 2,00,000/- and the same (19.00%) respondent had annual income above Rs. 2,00,000/-. and only (4.00%) of the respondents had annual income up to Rs. 50,000/-

Tayade (2016) reported that higher proportion of respondent were having annual income above Rs. 2 Lakh, followed by slightly less than one fifth (19.33%) respondent were having annual income up to 50,000/-. The (17.34%) respondent were having annual income 50,001 to 1 Lakh followed by (12.00%) respondent were having annual income between Rs. 1,00,001 to 1,50,000/- and (9.33%) respondent were having annual income between Rs. 1,50,001 to 2,00,000/-

Sikarwar, Rahul Singh (2019) reported that the majority of respondents (71.67%) were low annual income (up to Rs. 2.72 lakhs), whereas, (20.00%) respondent were medium annual income (Rs.2.72 to 4.96 lakh) and (8.33%) were high income (above Rs. 4.96 Lakh).

Jatesh Kathpalia *et al.* (2020) revealed that about half of the respondents (48.75%) belonged to medium (2.1 – 4.0 Lakh) income group while, (17.50%) belonged to high income group and (33.75%) had low income group.

Anuradha Ranjan Kumari *et al.* (2020) concluded that majority 45.55 per cent of the respondents had family income from 10,000 to 15,000

/- followed by 37.22 per cent respondents had 5000 to 10,000/-, 10.00 per cent respondent had above 15,000/- and only 7.22 per cent of respondents had family income below` 5000/- per month.

2.1.7 Area under soybean cultivation.

Mohite (2013) observed that area under soybean crop was found to have positive significant correlation with knowledge and adoption of bio fertilizer by soybean farmers.

Deogirkar (2014) observed that more than one third (35.83%) of the respondents had 1.01 to 2.00 ha area under soybean followed by (30.00%) of respondents put up to 1.00 ha area under soybean crop. Whereas, (24.17%) of the respondents put area between 2.01 to 4.00 ha. under soybean crop and only (10.00%) respondents put 4.01 to 10.00 ha area under soybean respectively. Thus, it is inferred from above table that majority of (65.83%) respondents put up to 2.00 ha area under soybean crop.

Singh, Shivpal (2015) concluded that out of total soybean growers, 31.82 per cent were sown soybean in 1 ha. area, where as 23.64 per cent were sown in area between 1.01 to 2 ha. and 39.09 per cent were sown 2.01 to 4 ha. and only 5.45 per cent were sown in more than 4 ha. of their total land holding.

Kale *et al.* (2015) observed that a selected farmer under wheat crop is observed in decreasing trend as, area under wheat up to 1 ha. is (67.00%) farmers, 1.01 to 2 ha. is (30.50%) farmers and above 2.00 ha. was observed with only (2.50%) wheat farmers.

Tayade (2016) concluded that higher proportion (34.00%) of the respondent had 2.01 to 4.00 ha. area under soybean fallowed by (30.00%) of respondent put up to 1.00 ha. area under soybean crop whereas, (29.34%) respondent put up to 1.01 to 2.00 ha. area under soybean crop and (6.00%) respondent put 4.01 to 10.00 ha. area under soybean crop respectively. Negligible respondents (0.66%) come under large i.e. above 10.00 ha. land holding category.

Hingne (2016) reported that (40.00%) respondent had 1.01 to 2.00 ha. area under soybean crop fallowed by (32.00%) respondent put 2.01 to 4.00 ha. area under soybean crop. Whereas, (16.00%) respondent put area up to 1.00 ha. under soybean crop and (11.00%) respondent put area up to 4.00 to 10.00 ha. under soybean crop. Only 1.00 per cent respondent come under large i.e. above 10.00 ha. area under soybean crop.

2.1.8 Source of information

Sawale (2011) revealed that 63.75 per cent of the pomegranate growers used medium sources of information while, 18.75 per cent and 17.50 per cent of them had low and high use of sources of information category, respectively.

Atar (2012) observed that 68.34 per cent of the grape growers used medium sources of information while, 20.0 per cent of them were in low and high use category, respectively.

Mane (2012) reported that 59.17 per cent of the green gram growers had used medium sources of information while, 15.00 per cent and 25.83 per cent of them had low and high sources of information.

Ghintala and Singh (2013) observed that (75.00%) of the farmers utilized medium sources of information followed by (14.17%) and (10.83%) who utilized low and high sources of information, respectively.

Lad (2013) observed that the (70.00%) of the green gram growers used medium sources of information while, (15.83%) high and (14.17%) had low use of sources of information category.

Katole *et al.* (2015) reported that majority (70.00%) of the respondents were used medium level of sources of information for getting information about adoption of composting methods.

Tayade (2016) observed that the distribution of respondent that were never contacting B.D.O. (100.00%) fallowed by project director (96.67%) then Agril. Extension officer (92.66%), agricultural officers (86%), Gramsevak (70.66%), University scientist/ KVK scientist (67.33%) and agriculture assistant (42.66%), whereas soybean growers sometimes

contacting the Agril. Assistant (50.67%) followed by University scientist/KVK scientist (30.67%) Gramsevak (18.76%), Agriculture Officer (11.34%), Agril. Extension Officer (3.34%) and Project Director (2.67%). and few soybean growers always contacting the Gramsevak (10.67%) followed by Agril. Assistant (6.67%). Agril. Extension Officer (4.00%), Agriculture Officer (2.66%), University Scientists/KVK Scientists (2.00%), and negligible of the respondents contacting with project director (0.66%).

Hingne (2016) reported that majority (63.00%) of respondent had medium level of source of information, whereas (20.00%) of respondent had low level of sources of information fallowed by (17.00%) respondent were having high level of sources of information.

Ramesh Chand *et al.* (2019) reported that majority of the farmers in Haryana (78.75%) and Punjab (81.89%) had consulted other farmers as source of Information for wheat management. Input dealers were least consulted in Punjab (3.13%) than Haryana (53.75%). State Agriculture Universities consulted by the farmers of Punjab and Haryana was 11.26 and 44.75 per cent respectively. As most of the farmers were literate so Newspaper (38.68%) and magazine (18.26%) were also consulted by the farmers of Punjab and Haryana. Radio was main source of information in Haryana (21.50%) than Punjab (6.39%). TV was also used by (19.25%) and (16.26%) in Haryana and Punjab respectively.

Sikarwar, Rahul Singh (2019) reported that the most of the respondent (64.17%) had medium source of information, while (29.16%) respondents had high and only (6.67%) had low source of information.

2.1.9 Extension contact

Sangeetha *et al.* (2009) reported that Majority of the cotton farmer were having medium contact with extension agency (47.50%).

Bhandare (2011) noticed that (70.00%) respondents had low extension contact, while (22.50%) of the respondents had medium extension contact whereas only (7.50%) of the respondents had high extension contact.

Mandlik (2012) revealed that 75.00 per cent respondents had medium level of extension contacts followed by 14.16 per cent of the respondents having high level of extension contact whereas the 10.84 per cent respondents had low level of extension contact.

Thorat (2013) noticed that 59.00 per cent of the respondents had medium extension contact, 22.00 per cent were having high extension contact, while 19.00 per cent were having low extension contact.

Deogirkar (2014) observed that, majority of respondents (71.66%) had medium category of extension contact followed by (16.67%) of respondents had low category of extension contact. Only (11.67%) of respondents had high category of extension contact.

Rajshekhar (2015) observed that majority (50.00%) of the respondents were found to possess medium extension contacts, followed by low (47.50%) and high (2.50 %) extension contacts.

Tayade (2016) reported that majority of respondents (67.34%) were in ‘medium’ category of extension contact followed by (17.33%) of respondents were in ‘low’ category of extension contact. However, (15.33%) of respondents were in ‘high’ category of extension contact.

Hingne (2016) reported that majority (65.00%) of respondent had medium level of extension contact. Whereas (23.00%) respondent had low level of extension contact fallowed by (12.00%) respondent was having high level of extension contact.

Waywal (2019) observed that, majority of respondents (60.00%) were having medium level of extension contact, while (28.33%) of respondents were having high level of extension contact. Only (11.67%) of respondents found to be in low level of extension contact

2.1.10 Economic motivation

Sangeetha *et al.* (2009) reported that majority of respondents had high economic motivation (39.17%).

Tilekar (2010) observed that majority of soybean growers (72.00%) belonged to medium category of economic motivation followed by (16.00%) of the soybean growers were in low category of economic motivation only (12.00%) of the soybean growers were observed in high level of economic motivation.

Deogirkar (2014) observed that, more than half of the respondents had medium category of economic motivation, followed by (23.34%) respondents had low category of economic motivation. Only (15.83%) respondents had high category of economic motivation.

Singh, Shivpal (2015) reveals that out of total soybean growers, 48.18 per cent had high economic motivation, followed by 48.18 per cent had medium and 3.64 per cent soybean growers had low economic motivation.

Tekale (2015) observed that more than half of respondents 64.00 per cent fell under medium category of economic motivation, followed by 19.00 and 17.00 per cent of respondents were fell under high and low level of economic motivation respectively. The reason for medium economic motivation of vegetable growers might be due to their marginal and semi medium land holding and medium level contact with extension agencies.

Hingne (2016) reported that majority (70.00%) of respondent had medium level of economic motivation fallowed by (24.00%) of respondent were having low level of economic motivation whereas (06.00%) respondent were having high level of economic motivation.

Jadhav (2017) found that majority (52.00%) of beneficiary farmers belonged to medium level of economic motivation and majority of non-beneficiary farmer belonged to medium level of economic motivation to the extent of (78.00%).

Manish Kumar *et al. (2019)* reported that economic motivation has shown their highly significant and positive relationship with adoption of integrated pest management practices.

2.1.11 Innovativeness

Sangeetha *et al.* (2009) reported that Medium level of innovativeness that is (47.50%).

Rajshekhar (2015) reported that, majority (55.00%) of the respondents had medium innovativeness followed by high (40.00%) and low (5.00%) innovativeness.

Gudadhe (2015) observed that, more than half per cent of the respondents (67.00%) were having medium level of source of information, while (19.00%) of respondents were having low level of sources of information. Only (14.00%) respondents were having high level of sources of information.

Naina, Virang (2016) showed that majority of the beneficiaries (41.54%) found to medium innovativeness group followed by low innovativeness group (32.30%) and high innovativeness group (26.16%) respectively.

Tayade (2016) that maximum number of the respondents (69.33%) were observed in medium level of innovativeness, followed by less than one fifth of respondents (16.67%) were observed in low level of innovativeness and remaining (14.00%) respondents were having high level of innovativeness.

Bhaltilak (2017) revealed that majority of cotton growers belongs to the medium category of innovativeness (48.00%) followed by (43.00%) of cotton growers belongs to high category of innovativeness and only (9.00%) of cotton growers belongs to low category of innovativeness.

2.1.12 Scientific orientation

Maraddi (2006) concluded that 46.11 per cent respondents were found in medium scientific orientation category, followed by 35.56 per cent in low category and 18.33 per cent in high scientific orientation category.

Lokhande (2007) concluded that majority (55.00%) of soybean growers had medium level of scientific orientation

Sangeetha *et al.* (2009) reported that majority of respondents were having high scientific orientation (40.83 %).

Rajput and Chinchmalatpure (2016) reported that scientific orientation and knowledge had positive and significant influence on their level of knowledge.

Tayade (2016) reported that majority of respondent (72. 66%) were in ‘medium’ category of scientific orientation followed by (16.00%) were in ‘low’ category and (11.34%) were in ‘high’ category of scientific orientation.

Sikarwar, Rahul Singh (2019) reported that the most of the respondent (65.83%) had medium scientific orientation, while (26.67%) had high and (7.50%) had low scientific orientation.

2.1.13 Knowledge

Ambhore (2006) revealed that majority of the soybean growers (75.33%) were found in high category of knowledge, followed by (24.67%) in medium category of knowledge. None of them was found in low.

Kale *et al.* (2014) observed that majority of 61.25 per cent soybean growers had medium level of knowledge followed by 35.00 per cent respondents had high level and 3.75 per cent respondents had low level category of knowledge about herbicide application practices in soybean and cotton crop

Deogirkar (2014) observed that, more than half of the (53.33%) respondents have observed in medium level of knowledge about selected herbicide application practices in soybean crop followed by (40.84%) respondents had high level of knowledge and remaining (5.83%) farmers noted in low level knowledge. This group may be the non-adopters of herbicide application practices. Thus, it was concluded that majority of respondents (94.17%) had knowledge about selected herbicide application practices.

Sikarwar, Rahul Singh (2019) reported that the most of the respondent (69.17 %) had partial knowledge, whereas (23.33%) had

complete knowledge and (7.50%) respondent had low knowledge about improved variety of soybean.

Waywal (2019) observed that, majority of the respondents (61.66%) belonged to medium category of knowledge followed by (24.17%) of respondents were included in high knowledge level and only (14.16%) of respondents were observed in low knowledge level. Thus, could be concluded that majority of the respondents found to be in medium category of knowledge level.

Noor ul Islam wani *et al.* (2020) revealed that, majority (60.00%) of the respondents had medium level of knowledge whereas, (23.00%) of the respondents had high level of knowledge and only (17.00%) of the respondents had low levels of knowledge.

Anuradha Ranjan Kumari *et al.* (2020) revealed that (52.78%), (28.33%) and (18.89%) respondents fell under the knowledge Categories of medium, high and low respectively as far as their overall knowledge about the recommended production technology of pigeon pea was concerned.

2.2 Dependent variables

2.2.1 Adoption

Savant (2011) concluded that majority of (57.00%) farmers had medium level of adoption of weed management practices only (25.00%) farmers had high level of adoption and (18.00%) respondents had low level of adoption.

Ashish Kumar (2012) revealed that more than two third (62.67%) of respondents were found in medium category of adoption followed by the farmers (20.00%) respondents belonging to high category of adoption, while only (17.33%) of them had low level of adoption of recommended technology of soybean.

Mohite (2013) observed that majority of soybean growers belonged to medium level of adoption.

Kale *et al.* (2014) observed that majority of respondents 92.08 per cent soybean growers adopted herbicides in soybean crop.

Tayade (2015) in his study observed that majority of the respondents (85.33%) were observed in 'low' level of adoption of broad bed furrow Technology, followed by (8.67%) of the respondents observed in 'medium' level of adoption category and remaining (6.00%) were found to have 'high' adoption of broad bed furrow Technology for soybean crop.

Rajput and Chinchmalatpure (2016) reported that majority of the respondents had medium (53.71 %) level of adoption towards cultivation practices of Bt. cotton.

Naina, Virang (2016) observed that majority of the beneficiaries 56.92 per cent found to have medium adoption of various components of soybean production technology under ATMA programme followed by high adoption 23.08 per cent and low adoption 20.00 per cent respectively.

Sikarwar, Rahul Singh (2019) reported that the most of the respondent (61.67 %) had partial adoption, while, (23.33%) had complete adoption and (15.00%) respondent had low adoption about improved soybean production technology.

Waywal (2019) observed that more than half of the respondents (58.33%) belonged to medium category of adoption level followed by (23.33%) of respondents were included in high adoption level and (18.34%) of respondents were observed in low adoption level. Thus, could be concluded that majority of the respondents found to be in medium category of adoption level.

Manish Kumar *et al.* (2019) reported that majority 35.00 per cent of total respondents had medium level of adoption, while 34.16 per cent had low and 30.83 per cent had high level of adoption.

Raviya *et al*. (2020) revealed that majority (68.33%) of the respondents had medium adoption about the recommended practices of cotton followed by high (18.33%) and low (13.34%) extent of adoption of recommended practices of cotton.

Anuradha Ranjan Kumari *et al*. (2020) revealed that maximum 57.22 per cent were Medium adopted. Whereas 27.22 per cent and 15.66 per Cent of the respondents are low and high adopters of pigeon pea cultivation technology respectively

2.3 Constraints

Ashish Kumar (2012) stated that due to lack of knowledge about weedicides and its proper use more than half of the (56.66%) farmers were unable to adopt the weedicides. It clearly indicated that besides situational and economical problem technical constraints were the most important hurdle in adoption of recommended technologies of soybean.

Mohite (2013) observed that lack of knowledge, lack of guidance and lack of timely finance was the major constraints in adoption bio fertilizer in soybean crop.

Kale *et al.* (2014) observed that over half 62.50 per cent of the farmers expressed that they were not get the proper information about herbicide application from extension functionaries

Deogirkar (2014) observed that in case of technical constraints about 25.00 per cent of the farmers expressed that they are not getting the proper information about herbicide applications from extension functionaries, this was followed by lack of proper knowledge 22.50 per cent respondents. More than one third 41.66 per cent respondents expressed the constraints of lack of labours for herbicide application. In case of financial constraints 45.83 per cent respondents faced the constraints of non-availability of money at proper time. In case of other constraints If rains occur after herbicide application not gets the effective results in weed control were mentioned by 20.83 per cent farmers and long gap in monsoon leads to delayed application of herbicide were expressed by 12.50 per cent farmers.

Tayade (2015) reported that majority of respondents (71.33%) were facing lack of information about BBF planter as a constraint followed by 60.00 per cent of respondents were stated financial problem as

a constraint whereas lack of information about BBF technology as reported as constraints by the respondents (44.00%) and little more than one fourth of respondents (26.67%) stated not getting the benefits of Government scheme for purchase of BBF planter and other related implements as constraints. The (16.67%) of the respondents were reported non availability of BBF planter.

Waywal (2019) observed that lack of technical knowledge about IPM practices (70.00%) was the major problem faced by the cotton growers, followed by of lack of proper guidance about pesticides use (55.00 %), however (50.00%) of respondents were having constraints of non–availability of inputs at right time (pheromone traps), while 49.17 per cent of respondents had lack of media advertisement, (46.67%) high cost of inputs and remaining (42.50%) of respondents had unavailability of skilled labours.

2.4 Conceptual model of research study

During the course of investigation the researcher has to assume relations amongst selected variables and to develop a conceptual model. A model helps in critical and logical thinking about the research problem. Theoretical model represents the concepts and variables used in research. Based on foregoing review of the past research studies a conceptual model has been developed for the present study and the same has been depicted in Fig. 1.

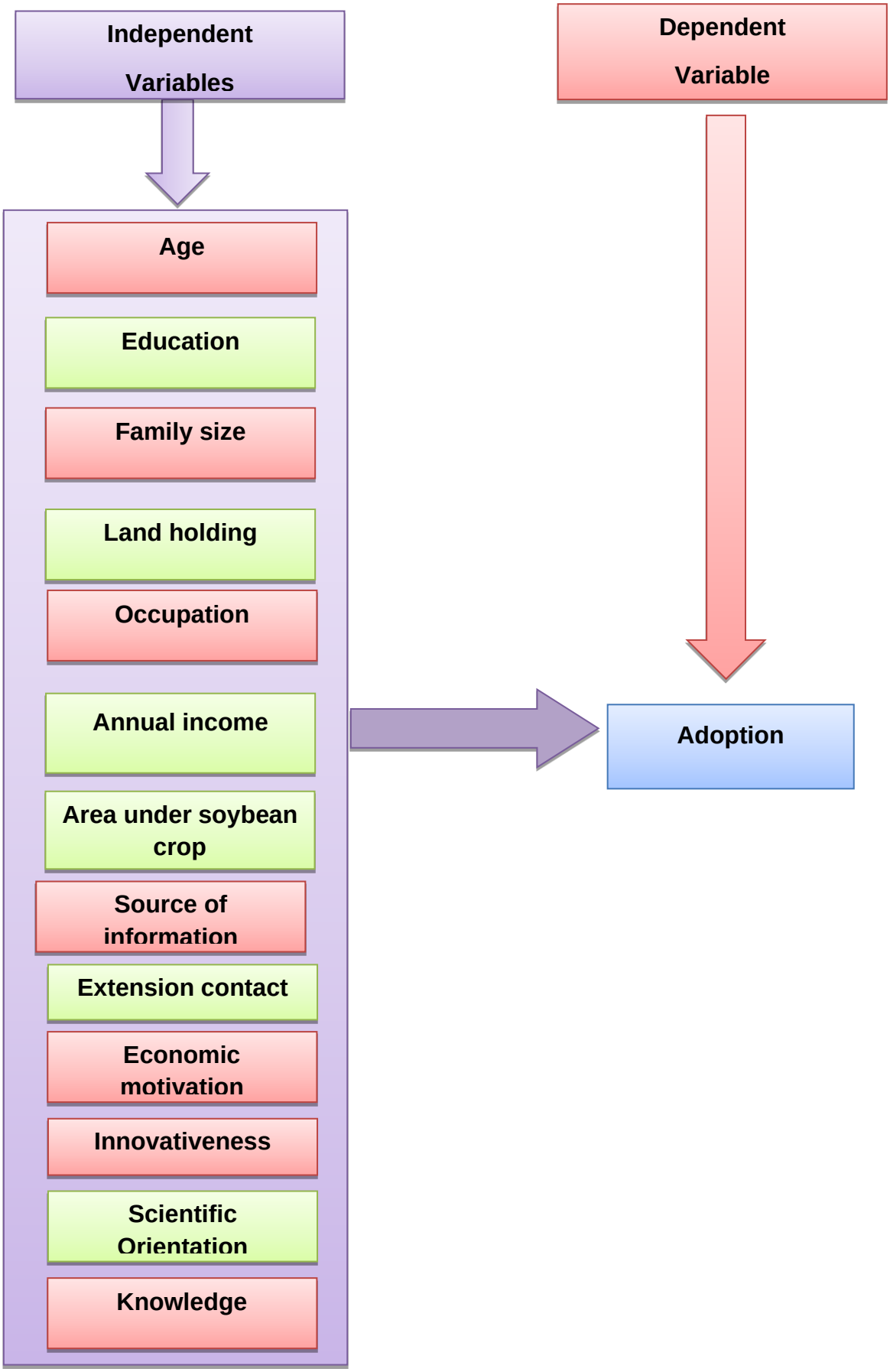

Fig 1: Conceptual model of study

CHAPTER III

METHODOLOGY

Research technique offers with the outline of studies approach and strategies utilized in present study. For present research special technique changed into advanced for reading numerous components in line of the unique targets and has been defined on this chapter.

Considering the significance of studies technique it's been divided into applicable sub-section as a way to permit logical presentation as definitions, concept, methods, method and approach used for present study the equal has been defined with applicable information below following heads.

3.1 Locale of study

The present study was conducted in Latur District in Marathwada region of Maharashtra State. A multistage purposive random sampling technique was used for the study. In the first stage, out of eight Districts in Marathwada region Latur District was purposively selected on

the basis of maximum area under soybean cultivation. The entire District occupies an area of about 7,157 square kilometer.

3.1.1 Location of District

Latur District is in the Marathwada region in Maharashtra in India, located between 17°52' North to 18°50' North and 76°18' East to 79°12' East in the Deccan plateau. It has an average elevation of 631 meters (2,070 ft.) above mean sea level. The entire District of Latur is on the Balaghat plateau, 540 to 638 meters from the mean sea level. Latur District is bound by Nanded District to the northeast; the state border with Karnataka to the east and southeast; Osmanabad District to the south-west; Beed District to the west; and Parbhani District to the northwest. Administratively the District is divided into five subdivisions namely Latur, Nilanga, Ausa, Ahmadpur and Udgir further divided into ten Talukas these are Latur, Udgir, Ahmadpur, Ausa, Nilanga, Renapur, Chakur, Shirur Anantpal, Deoni and Jalkot. Latur is the administrative headquarter of the District. There are around 945 Villages & 786 Gram Panchayats in the District.

3.1.2 Area and population

The District has an area of 7,157 sq.kms. and as per 2011 Census it has a population of 24,54,196 persons. While the area of the District accounts for 2.33 per cent of the total area of the State, the District population constitutes 2.18 per cent of the total population of the State. The density of population is 343 persons per sq. km. Among the 35 Districts of the State, the District ranks 23rd in terms of area, 20th in terms of population and 11th in terms of density.

3.1.3 Topography and soil

The soils of the District are essentially derived from the trap rocks and can broadly be classified into four groups, viz., shallow soils having thickness up to 9 inches, medium soils (9-18 inches), medium deep soils (18-36 inches) and deep soils (above 36 inches).Shallow soils are mainly located in the north-eastern part of the District. Patches of medium

soils occur mainly near Nilanga and central portions of the District. Medium deep soils vary from dark grey brown to very dark brown in color and are found scattered in the northern parts of the District.

3.1.4 Climate and rainfall

Temperatures in Latur range from 13 to 41 °C (55 to 106 °F), most of the rainfall occurs in the monsoon season from June to September. Rainfall varies from 9.0 to 693 millimeters (0.35 to 27.28 in) per month. Average annual rainfall is 725 millimeters (28.5 in).

3.1.5 Land use pattern

Table 2: Land use pattern of Latur District.

Sr. No.	Particular	Area ('000ha)
1.	Total geographical area	715.7
2.	Cultivable area	657.7
3.	Area under forest	1.8
4.	Land under non- agricultural use	21.4
5.	Permanent pastures	21.3
6.	Land under miscellaneous tree crops and grooves not included in net area sown	20.9
7.	Cultivable waste land	24.1
8.	Barren and uncultivable land	18.9
9.	Current fallow	46.4

Source: Agriculture Statistical Information Maharashtra State 2005-2006 (Part – II) (Maharashtra socio-economic database, 2010)

3.1.6 Cropping pattern

Table 3: Cropping pattern of Latur District.

Sr. No.	Crop	Area ('000ha)
1.	Wheat	27.4
2.	Sorghum	169.7
3.	Gram	43.1
4.	Tur	70.9
5.	Green gram	24.9
6.	Black gram	66.9
7.	Soybean	155.3
8.	Sunflower	14.1
9.	Safflower	8.5
10.	Sugarcane	33.5
11.	Total Horticultural crops and Vegetables	23.89

Source: Agriculture Statistical Information Maharashtra State 2005-2006 (Part – II) (Maharashtra socio-economic database, 2010)

3.1.7 Input supply

Agricultural inputs like seed, manure, fertilizers, insecticides, pesticides etc. are required by the farmers are made available to farmers through number of agricultural service centers working at District stage and block stage.

Maharashtra State Seed Corporation Ltd. (MAHABEEJ), Dr. PDKV, Akola and other private seed corporations deliver the best the quality seeds to the farmers. There are Krishi Sewa Kendra working at Village level provide agricultural inputs. The farm inputs are made available to the farmers by co-operative societies and nationalize banks performing at block level, talukas also provide inputs to the farmers. Co-operative society supply input against the loan sanctioned by the District Central Co-operation Bank to individual cultivator.

3.1.8 Market

For the marketing of agricultural produce, agricultural produce market committees are functioning in the District. All ten tahsils are having facilities of regulated markets functioning in the District. These sub-markers are connected with roads and having facilities of banking, electricity etc. it consist of various agencies, which performs the different marketing functioning sequence as to move produce from the place of production to the ultimate consumer.

3.2 Research design

The emphasis of the study was on adoption of integrated weed management practices of soybean growers for assessing adoption and constraints faced by the farmers in adoption of IWM practices on soybean crop. The exploratory design of social research was used in present investigation.

3.3 Sampling plan

The present study was purposively conducted in Renapur and Shirur Anantpal talukas in the Latur District as most of the farmers grow soybean crop. The sampling plan adopted for this research study was as follows.

3.3.1 Selection of Villages

Among the selected Talukas from Latur District six Villages from Renapur Taluka and six Villages from Shirur Anantpal Taluka were selected. Thus the total 12 Villages were selected from two Talukas.

3.3.2 Selection of respondents

From each selected Village, 10 soybean growers were selected purposively for the present study. Thus, total 120 soybean growers as respondents were selected purposively, who are growing soybean from last minimum three year. Thus 120 respondents were selected for the present study for making the sample size of 120 in total.

Table 4: List of Village wise respondents selected for the study

Sr. No.	Name of Village	No. of respondents
1	Shirur Anantpal	10
2	Kambalga	10
3	Aari	10
4	Shivpur	10
5	Rapka	10
6	Kaslewadi	10
7	Renapur	10
8	Hanmantwadi	10
9	Samsapur	10
10	Kamkheda	10
11	Kharola	10
12	Koshtagaon	10
	Total	**120**

3.4 Preparation of interview schedule

In order to obtain information about adoption of integrated weed management practices by soybean grower, the structured interview schedule was developed.

The interview schedule was designed by formulation of relevant questions in accordance with study objective. The interview schedule was divided into two parts. The first part of the interview schedule included the question related to general, personal, socio-economic, communication, situational and psychological characteristics of the farmers.

The questions regarding adoption and constrains faced by the soybean growers in adoption of IWM practices were included in second part. The standardized scales and teacher made scales were used for measurements of variables. The schedule was developed in English and all the question were asked in local language i.e. in Marathi for ease in understanding by the respondents and eliciting appropriate response from respondents.

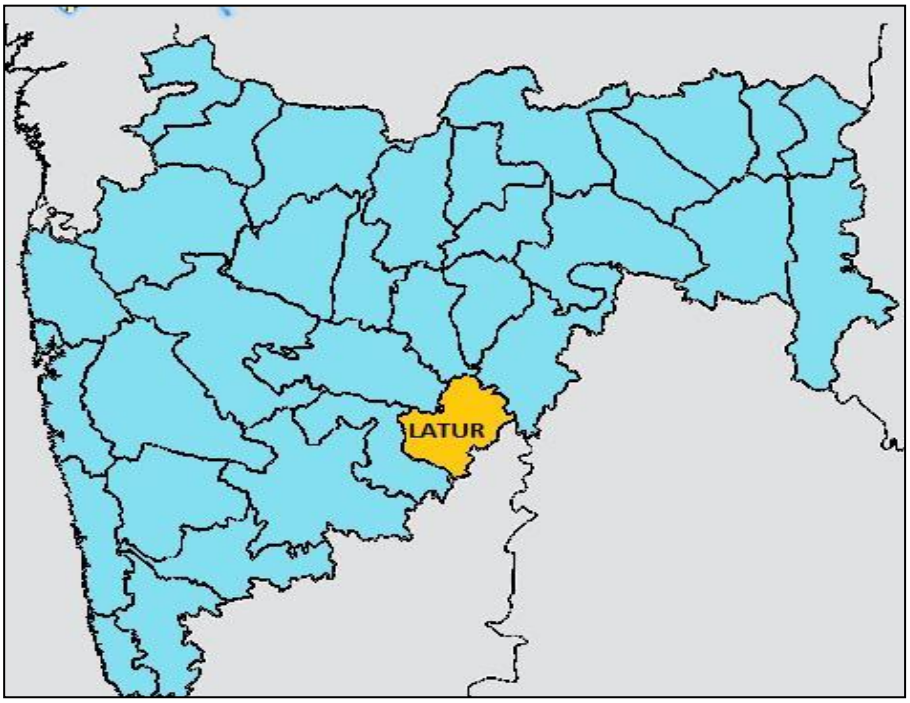

Fig 2: Map of Maharashtra showing location of Latur District.

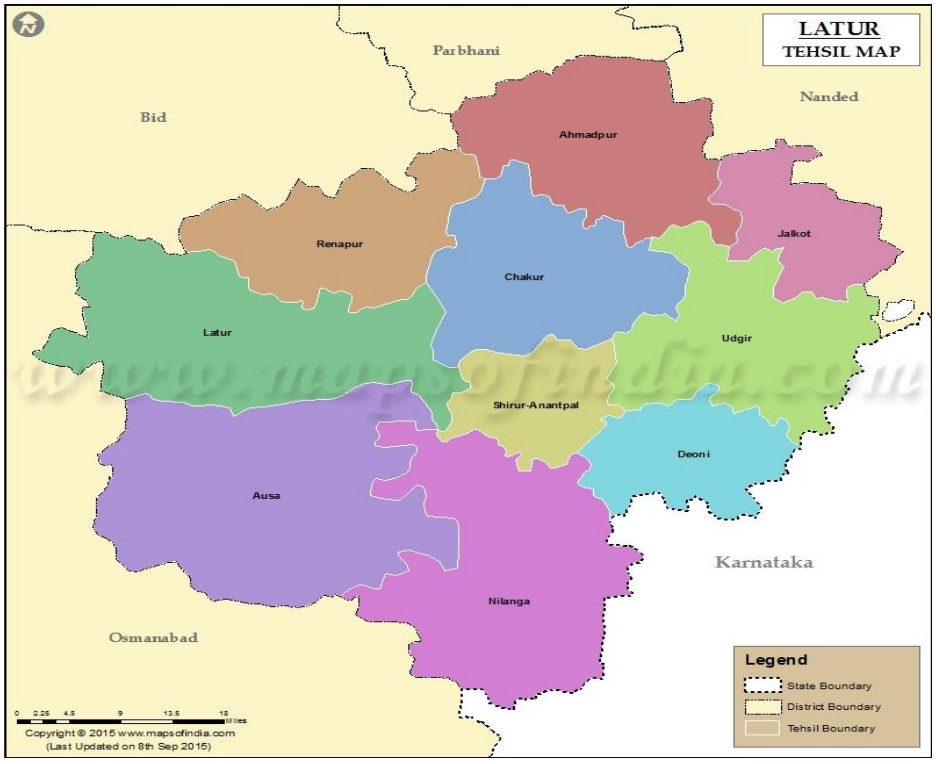

Fig 3: Map of Latur District showing Tahsils selected for the study.

3.5 Pre-testing of interview schedule

The pre-testing of interview schedule was done on 15 soybean growers in Aari Village of the Shirur Anantpal talukas. These farmers were not included in the sample of respondents. The data collected from such non-sampled respondents were thoroughly studied to detect the unfamiliar words and complexity of questions included in the schedule. Before finalization of interview schedule, the interview schedule was getting checked from Subject Matter Specialist of Agronomy Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola and Respected Chairman of advisory committee and then necessary corrections were incorporated.

Interview schedule was pre-tested to correct the mistake and short fall to ensure the clarity, validity and practicability of the schedule. Necessary modifications were incorporated in the final schedule wherever necessary after pre-testing.

3.6 Collection of data

The data were collected in fact to face situation by personally contacting the selected farmers. The farmers were contact at their farm to observe actual situation in the field.

Before actually seeking actual information, the researcher has introduced himself with the farmers and narrated the objectives of present study. The pretested interview schedule was used for data collection.

3.7 Variables and their empirical measurements

The variables were selected with the consultation of experts in the field of extension education and agronomy after review of available literature. The details about variables selected for study and their empirical measures are furnished below.

Plate 1: investigator interviewing with farmer

Plate 2: Investigator interviewing with farmer.

Plate 3: Investigator interviewing farmer.

Plate 4: Investigator interviewing farmer and his family.

Table 5: Variables and their measurements

Sr. No.	Variables	Empirical measurements
I	**Independent variable**	
1	Age	Chronological age from birth in years was considered as the score of an individual soybean grower.
2	Education	Number of years of formal schooling completed by the soybean growers. The numerical score of one assigned for each year of schooling.
3	Family size	The number of members living in family.
4	Land holding	Number of hectares of land possessed by the soybean growers was treated as his/her score.
5	Occupation	It is operationally defined as the profession of soybean growers as the source of income.
6	Annual income	Gross income in rupees received by soybean growers and his family members from all scores in a year
7	Area under soybean crop	It refers to actual area in hectares put under soybean crop by the soybean growers.
8	Sources of information	All probable sources of information about integrated weed management practices in soybean were listed out and soybean grower's responses to them were elicited on three point continuum. Always, sometime and never.
9	Extension contact	Extension contact of respondents refers to the various extension contact made by individual soybean grower with formal and informal extension agencies for seeking information about use of IWM practices in soybean crop.
10	Economic motivation	The scale developed by Supe (1969) was used.
11	Innovativeness	Scale developed by Singh (1972) was used.
12	Scientific orientation	Scale developed by Supe (1969) was used.
13	Knowledge	The teacher made knowledge test was developed. Knowledge index were worked out.
II	**Dependent variable**	
14	Adoption	The teacher made adoption scale was developed. Adoption index were worked out.

3.8 Operationalization, categorization and quantification of variables

3.8.1 Independent variables

"Independent Variables are the presumed cause of dependent variables presumed effect". The independent variables selected for the present study, their operational definitions, scoring and categorization have been discussed below.

3.8.1.1. Age

It is operationally defined as chronological age of the respondent in completed years at the time of interview. It refers to chronological age of soybean growers in completed year at the time of interview. The categorization was done on the basis of actual age of farmer at the time of data collection.

Sr. No.	Category	Age (years)
1	Young	Up to 35
2	Middle	36 to 50
3	Old	Above 51

3.8.1.2. Education

It refers to the formal schooling of an individual from primary schooling to university degree. It was taken as number of standards in formal school passed by the individual. The categorization on the basis of educational level of the selected respondents was done as follows

Sr. No.	Category	Standard passed
1	Illiterate	No. schooling
2	Primary school	1^{st} – 4^{th}std
3	Middle school	5^{th} – 7^{th}std
4	High school	8^{th} – 10^{th}std
5	Higher secondary school	11^{th} – 12^{th}std
6	Graduate	Above 12^{th}std
7	Post graduate	Above graduation

3.8.1.3. Family size

It refers to the actual number of members living in a family. In the present study family size was decided according to the number of family member in the family including the farmer for relational analysis, total number of family member was considered as score of the family size of the farmer and categorization was done as follows.

Sr. No.	Category	Family members
1	Small	Up to 4
2	Medium	5 to 7
4	Large	Above 7

3.8.1.4 Land holding

It refers to the number of hectares of land possess by an individual respondent. It includes irrigated, fallow and rain fed land possessed by them. The categorization of land holding was prescribed by Government of Maharashtra Land Reform Act as follow.

Sr. No.	Category	Land holding (ha.)
1	Marginal	Up to 1.00
2	Small	1.01 – 2.00
3	Semi medium	2.01 - 4.00
4	Medium	4.01 – 10.00
5	Large	Above 10.00

3.8.1.5 Occupation

It is operationally defined as the profession of respondents as the source of income. The categorization on the basis of their profession, the soybean growers was categorized and scored.

Sr. No	Occupation	Score
1	Agriculture + Labor	1
2	Only Agriculture	2
3	Agriculture + Allied occupation (goat farming/poultry/fisheries)	3
4	Agri. + business - (professional/non-professional)	4
5	Agri. +Service/pension	5

3.8.1.6 Annual income

It refers to gross earning of an individual respondent and his family members in terms of rupees received from all sources in a year. The respondent was categorized on the basis of actual data collected.

The categorization i.e. low, medium and high was done on mean ± standard deviation values obtained from the data collected.

Sr. No.	Category	Income range
1	Low income	Up to Rs. 2,25,415
2	Medium annual income	Rs. 2,25,416 to Rs. 6,88,551
3	High annual income	Above 6,88,551

Mean = 4,56,983 S.D. = 2,31,568

3.8.1.7 Area under soybean crop

It operationally refers to the actual area under soybean crop of each individual farmer. It was considered his score for relational purpose. Categorization was done on the basis of minimum and maximum area under cultivation of soybean crop. Scoring was done on actual data collected.

The categorization i.e. low, medium and high was done on mean ± standard deviation values obtained from the data collected.

Sr. No.	Category	Area (ha.)

1	Low	Up to 2.11 ha.
2	Medium	2.12 to 5.27 ha.
3	High	Above 5.27 ha.

Mean = 3.69 S.D. = 1.58

3.8.1.8 Source of information

It refers to different information used by the respondents for seeking information about weed management practices followed by soybean growers.

Source of information used by farmers to obtain information about weed management practice followed by soybean growers was considered as personal localite, personal cosmopolite, extension agencies and audio-visual aids. Scoring was done on the basis of their response to the sources of information. A score of (2) always, (1) sometimes, and zero for never responses for seeking the information. Thus, total score for each individual was calculated and this was considered as individual score for information. On the basis of mean and standard deviation, the respondents were categorized into three groups' viz. low, medium and high.

Sr. No	Category	Score
1	Low	Up to 25
2	Medium	26 to 31
3	High	Above 31

Mean = 28.21 S.D. = 3.22

3.8.1.9 Extension contact

It is defined as the degree to which the contact of farmers with change agent such as Gramsevak, Extension officer and Scientist etc.

It was measured in terms of number of frequencies of contact with extension personnel. For measurement of extension contact schedule was developed. It was measured always, sometime and never by assigning score 2, 1 and 0 respectively. On the basis of total obtained

score of each respondent, they were categorized on the basis of mean and standard deviation as follows.

Sr. No.	Category	Score
1	Low	Up to 6
2	Medium	7 to 10
3	High	Above 10

Mean = 7.86 S.D. = 2.32

3.8.1.10 Economic motivation

It refers to occupational success measured in profit maximization and the relative value placed by an individual.

For measurement of economic motivation, the economic motivation scale developed by Supe (1969) was used. It consists of six statements out of these statements five statements are positive and rest one is negative. The score 5,4,3,2 and 1 were assigned for strongly agree, agree, undecided, disagree and strongly disagree respectively for positive statement. Reverse scoring was done for negative statements. The categorization of respondents was done on mean and standard deviation into three categories i.e. low, medium and high.

Sr. No.	Category	Score
1	Low	Up to 19
2	Medium	20 to 25
3	High	Above 25

Mean =22.59 S.D. = 3.39

3.8.1.11 Innovativeness

Rogers (1995), defined innovativeness as the degree to which an individual adopts the ideas earlier than other members in the social system. It is operationally defined as the degree to which respondent adopts the idea regarding improved cultivation practices of soybean crops.

Scale developed by Singh (1972) was used, to measure innovativeness with slight modifications. It consists of six statement out of them statement number 1, 4 and 5 are positive and statement 2, 3, 6 are negative. Positive statements are assigned score 3, 2 and 1 for response categories, viz., agree, undecided, disagree. Reverse for negative statement. The categorization was done on the basis of mean and standard deviation.

Sr. No.	Category	Score
1	Low	Up to 9
2	Medium	10 to 14
3	High	Above 14

Mean = 11.86 S.D. = 2.87

3.8.1.12 Scientific orientation

It is operationally defined as the degree to which an individual respondent oriented towards the use of scientific methods in farming and decision making.

It was measured with the help of scale developed by Supe (1969) with due modifications. The scale consists of six statements in which 1, 2, 3, 4 and 5 statements are positive statements and statement 6 is negative statement. The responses of the respondents was measured on 5 point continuum viz., strongly agree, agree, undecided, disagree and strongly disagree with score of 5, 4, 3, 2 and 1 respectively for positive statements and reverse scores was assigned for negative statement. Based on the total score, the respondents were classified into three categories on the basis of mean ± standard deviation as below.

Sr. No	Category	Score
1	Low	Up to 18
2	Medium	19 to 24
3	High	Above 24

Mean = 21.85 S.D. = 3.04

3.8.1.13. Knowledge

English and English (1961) defined knowledge as body of understood information possessed by an individual.

The teacher made test was used to measure the knowledge level of respondents about the integrated weed management practices. IWM practices were decided by referring University diary and in consultation with subject matter specialist of Department of Agronomy Dr.PDKV, Akola. The answers elicited from the soybean growers was quantified by giving '1' score to correct and '0' to wrong answers.

On the basis of raw score obtained the knowledge index was calculated by using following formula.

$$\textbf{Knowledge index} = \frac{\text{Actually obtained knowledge score}}{\text{Maximum obtainable knowledge score}} \times 100$$

The respondents were categorized on the basis of knowledge index into three categories i.e. low, medium and high by equal interval method.

Sr. No.	Category	Index range
1	Low	Up to 33.33
2	Medium	33.34 to 66.66
3	High	66.67 and Above

3.8.2 Dependent Variable

3.8.2.1 Adoption

Rogers (1983) defined adoption as the decision to make full use of innovation as the best course of action available.

Adoption in present study was defined as actual use of integrated weed management practices by the respondents in soybean crop.

For measurement of adoption level of IWM practices a list of IWM practices was prepared in consultation with subject matter specialist of Department of Agronomy of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola for getting their advice regarding selection of practices to be included in the adoption test. Adoption was measured on three-point continuum as complete adaption, partial adoption and no adoption by assigning the score 2, 1 and 0 respectively.

The raw adoption score obtained by an individual respondent was converted adoption index it was calculated by using fallowing formula.

$$\textbf{Adoption Index} = \frac{\text{Actually obtained adoption score}}{\text{Maximum obtainable adoption score}} \text{ X } 100$$

On the basis of obtained adoption index score, respondents were categorized in low, medium obtainable and high categories with the help of equal interval method, as follows.

Sr. No.	Category	Index range
1	Low	Up to 33.33
2	Medium	33.34 to 66.66
3	High	66.67 and Above

3.8.3. Constraints

The Oxford dictionary meaning of word constraint is confinement, restriction or liberty or compulsion of circumstances or compulsion put upon the behavior. Constraints have been operationally defined as the problem or difficulties encountered with the adoption of application of IWM practices in soybean. Collecting the response of soybean growers through an open end question the constraints was recorded. The frequency and percentage of each constraint was worked out to decide the intensity of the constraints encountered by the respondents.

3.9 Tabulation and analysis of data

The collected data were carefully examined for completeness and correctness before tabulation. Both quantitative and qualitative classes were formed. In case of some variables, the classes were formed arbitrarily while in case of some variable, accepted standard classification was adopted, for some others the mean and standard deviation were considered for forming of classes. The data were then tabulated and the frequencies and percentage in each category were worked out.

3.10 Statistical Method Used

Various statistical methods have been used for analysis and for facilitating meaningful interpretation of the data. Following statistical method have been used for the present study.

1) Arithmetic mean. $\overline{X}$
2) Standard deviation (S.D.)
3) Coefficient of correlation (r)

1) Arithmetic mean (X)

Mean was calculated by summing all the individual scores and dividing it by the number of cases. The formula was,

$$\bar{X} = \frac{\sum x}{N}$$

Where,

$\bar{X}$ = the arithmetic mean

$\sum X$ = Score of x series

N = No of respondent

$\sum$ = The Greek Latin word denotes “sum of “

2. Standard deviation (S.D.)

The standard deviation is the most stable index of variability and is employed in research studies.

It measure of variability calculated around mean. The usual symbol of the S. D. is Greek Letter (sigma). The following formula of S.D. was used.

$$\sigma = \sqrt{\frac{N\Sigma x^2 - (\Sigma x)^2}{N}}$$

Where,

σ = Standard deviation.

Σx^2 = Sum of square of X series.

$(\Sigma x)^2$ = Square of sum of X series.

N = Number of respondents.

3. Coefficient of correction (r)

The relationship between independent and dependent variable is established by calculating coefficient of correlation with the help of following formulae and it is denoted by 'r'.

$$r = \frac{\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{[N\Sigma x^2 - (\Sigma x)^2][(N\Sigma y^2 - (\Sigma y)^2)]}}$$

Where,

r = coefficient of correlation.

Σx = sum of the score of variable x.

Σy = sum of the score of variable y.

Σxy = sum of the products of x and y variable.

Σx^2 = sum of square of x variables.

Σy^2 = sum of square of y variables.

N = Total number of respondents.

If 'r' calculated value was more than the table value, at 0.01 and 0.05 level of probability if (N-2) degree of freedom, the relationship was considered to be significant. The review of past literature makes the

researchers aware about the methods, procedures and techniques available and used, as well as the outcomes and conclusions of the past studies. It provides guidance about the research process. Attempts have been made to gather findings having relevance with the topic under study.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter deals with results obtained from the analysis of the data of the present study along with their discussion thereon. The data have been organized and analyzed taking into account the study objectives. The results have been presented under the following heads.

4.1 Distribution analysis

4.1.1 Distribution of the respondents according to their personal, socio-economic, communication, situational and psychological characteristics.

4.1.2 Distribution of the respondents according to their adoption about integrated weed management practices by soybean growers.

4.2 Relational analysis

4.2.1 Relational analysis of independent and dependent variables.

4.3 Constraints analysis

4.3.1 Constraints in adoption of integrated weed management practices of soybean growers.

4.4 Empirical research model

4.1.1 Distribution of the respondents according to their personal, socio-economic, communication, situational and psychological characteristics.

The study of personal, situational, socio-economic, communication, situational and psychological characteristics was made with reference to age, education, family size, land holding, occupation, annual income, area under soybean crop, sources of information, extension contact, economic motivation, innovativeness, scientific orientation and knowledge. The results have been presented under the following sub heads.

4.1.1.1 Age

Age could be the contributory factor in determining the role of the respondent farmers in adoption of recommended IWM practices in soybean. Keeping view the information regarding the age of respondents was collected with a view to study their distribution in different age group and presented in Table 6.

Table 6: Distribution of the respondents according to their age

Sr. No.	Age Category (years)	Respondents (n=120)	
		Frequency	Percentage
1	Young (Up to 35)	30	25.00
2	Middle (36 to 50)	62	51.67
3	Old (Above 51)	28	23.33
	Total	**120**	**100.00**

It is observed from Table 6 that nearly half of the respondents (51.67%) belonged to middle age group category having age between 36 to 50 years. It was followed by (25.00%) of the respondents who belonged to young age category i.e. up to 35 years and remaining (23.33%) of the respondents were observed to be in old age category i.e. above 51 years. Thus, it was concluded that, half of the respondents were in the category of middle age group.

Similar findings were observed by Mohite (2013), Deogirkar (2014), Barkade (2015), and Jatesh Kathpalia *et al.* (2020) stated that majority of soybean grower's belonge to middle age group of category and support to the observations of present study.

4.1.1.2 Education

Education is one of the most important variables that have been considered as with the help of which desirable social change can be achieved. The educational level of the respondents was studied and the result has been presented in Table 7.

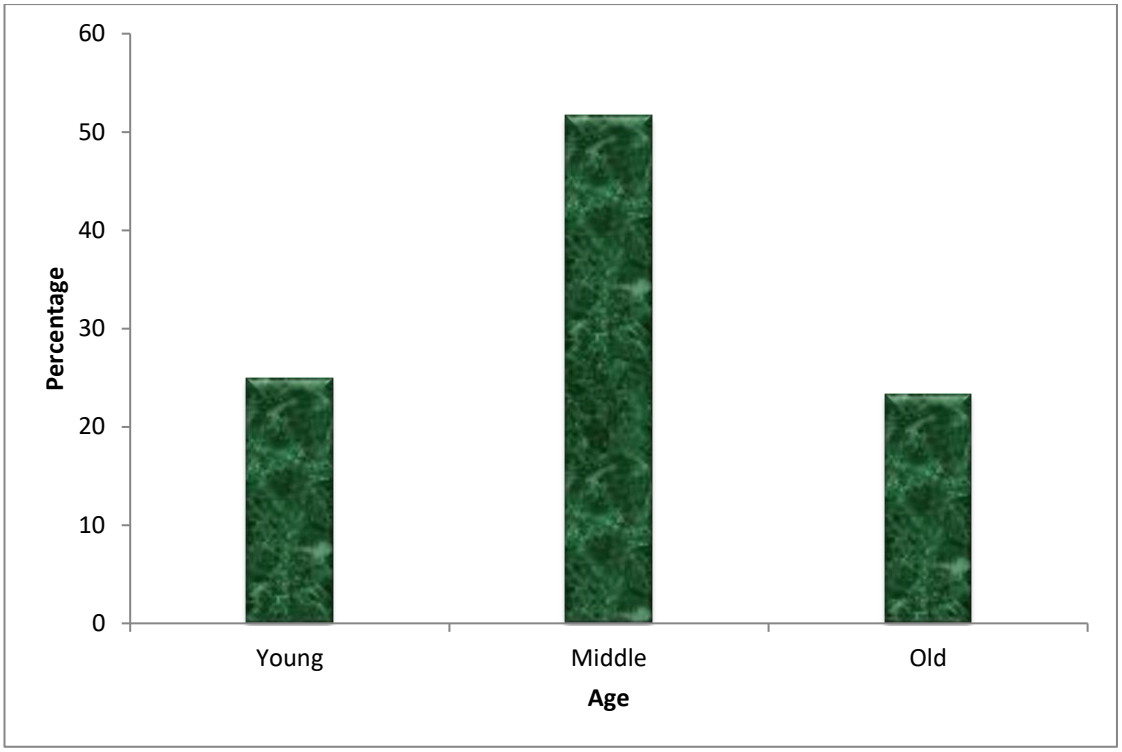

Fig. 4: Distribution of the respondents according to age

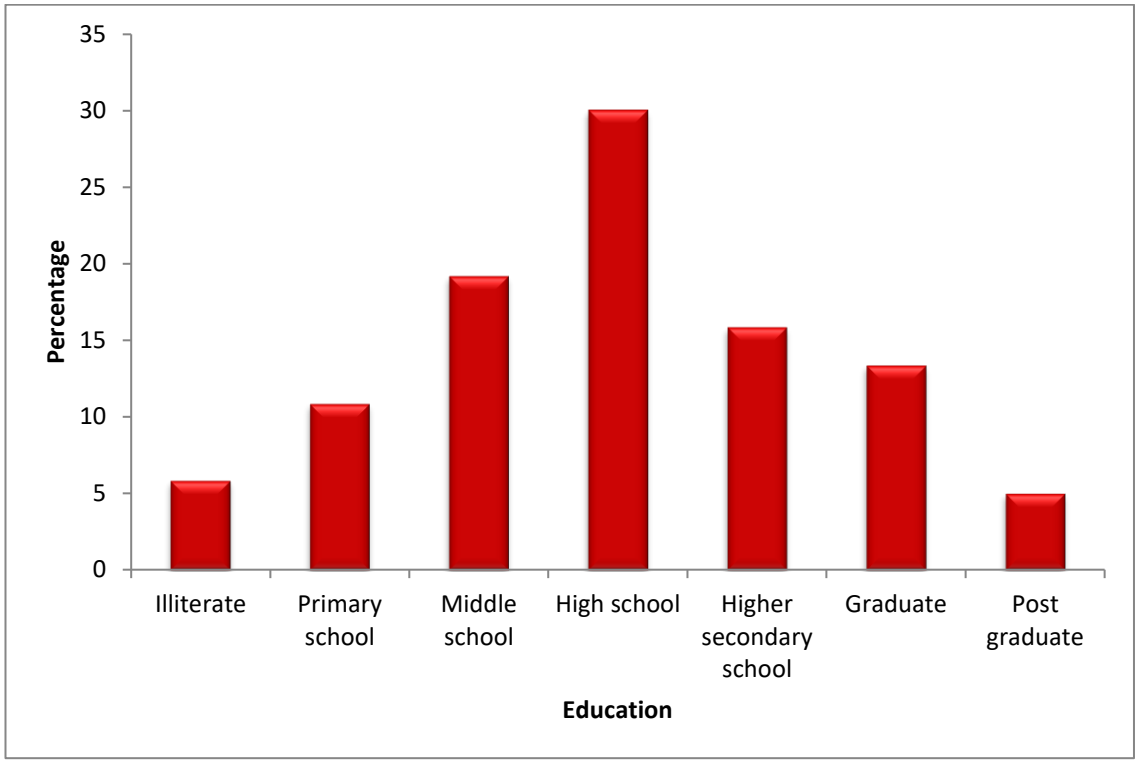

Fig. 5: Distribution of the respondents according to education

Table 7: **Distribution of the respondents according to education**

Sr. No.	Education	Respondents (n=120)	
		Frequency	Percentage
1.	Illiterate (No schooling)	07	05.83
2.	Primary school (1st to 4thStd.)	13	10.83
3.	Middle school (5th to 7th Std.)	23	19.17
4.	High school (8th to 10thStd.)	36	30.00
5.	College level (Above 11thStd.)	19	15.83
6.	Graduate	16	13.34
7.	Post graduate	06	05.00
	Total	**120**	**100.00**

It is observed from the table 7 that, over one third of the respondents (30.00%) were educated up to high school level education, (19.17%) respondents were educated up to middle school level followed by college level (15.83%), graduate (13.34%), primary school level (10.83%) and post graduate (05.00%) However it was also observed that, (5.83%) respondents were illiterates who have not attended any formal schooling.

Thus it was concluded that, majority of the respondents were educated up to high school level (30.00%) & middle school level (19.17%) respectively.

These findings were similar with Ashish Kumar (2012), Kale *et al.* (2014), Deogirkar (2014), Barkade (2015) stated that near about one third of the respondent were educated up to high school level.

4.1.1.3 Family size

The distribution of the respondents according to size of family presented in table 8 represent that, (56.67%) of the respondents belonged to medium size of family having (5 to 7) members, (25.00%) of the respondents had large size family (Above 7 members) and it was

followed by (18.33%) of the respondents who were under small family size (1 to 4 members).

Table 8: Distribution of the respondents according to family size

Sr. No.	Family members	Respondents (n=120)	
		Frequency	Percentage
1	Small (1 to 4)	22	18.33
2	Medium (5 to 7)	68	56.67
3	Large (Above 7)	30	25.00
	Total	**120**	**100.00**

Yasankar (2010) had also reported that majority of families under their study belonged to medium family size and support the findings of the present study.

4.1.1.4 Land holding

It is assumed that land owned by an individual explains his ability to bear risk, to adopt innovations and to invest the land in cultivation of various crops. Taking into consideration the status of land holding by the respondents was studied and the distribution of the respondents according to land holding is presented in table 9.

Table 9: Distribution of the respondents according to land holding

Sr. No.	Land holding (ha.)	Respondents (n=120)	
		Frequency	Percentage
1.	Marginal (Up to 1.00 ha)	09	07.50
2.	Small (1.01 to 2.00 ha)	21	17.50
3.	Semi-medium (2.01 to 4.00 ha)	42	35.00
4.	Medium (4.01 to 10.00 ha)	32	26.67
5.	Large (Above 10 ha)	16	13.33
	Total	**120**	**100.00**

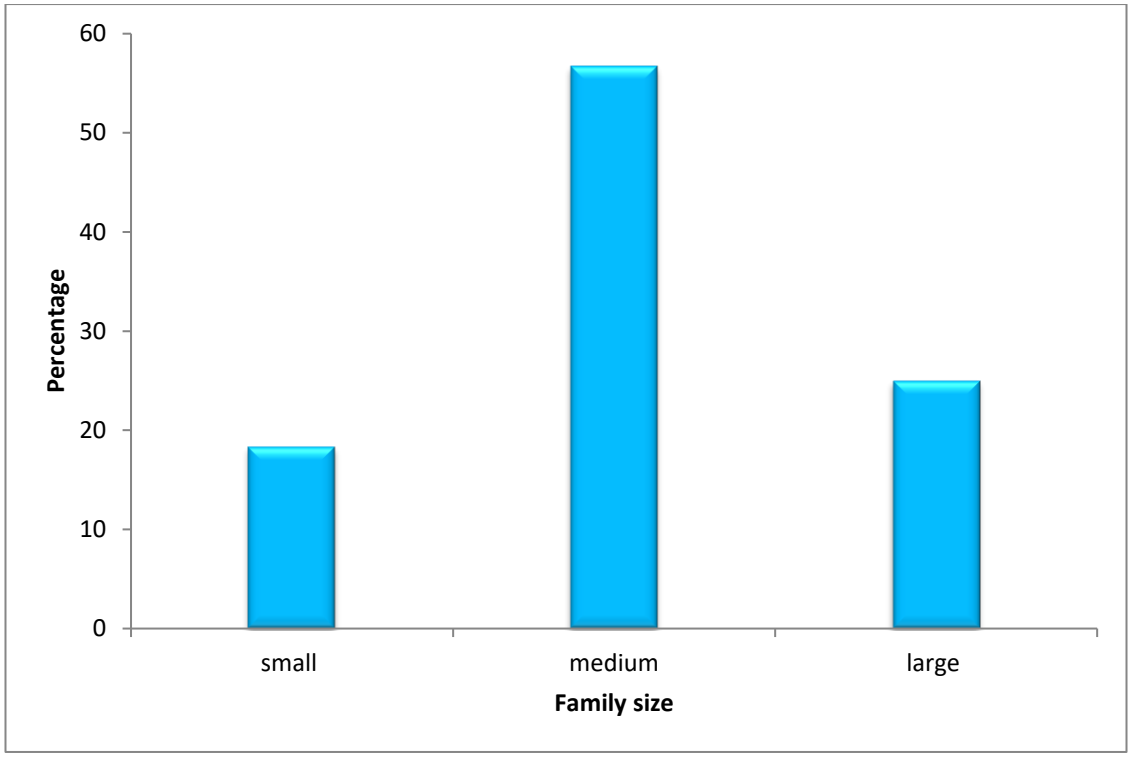

Fig. 6: Distribution of the respondents according to family size

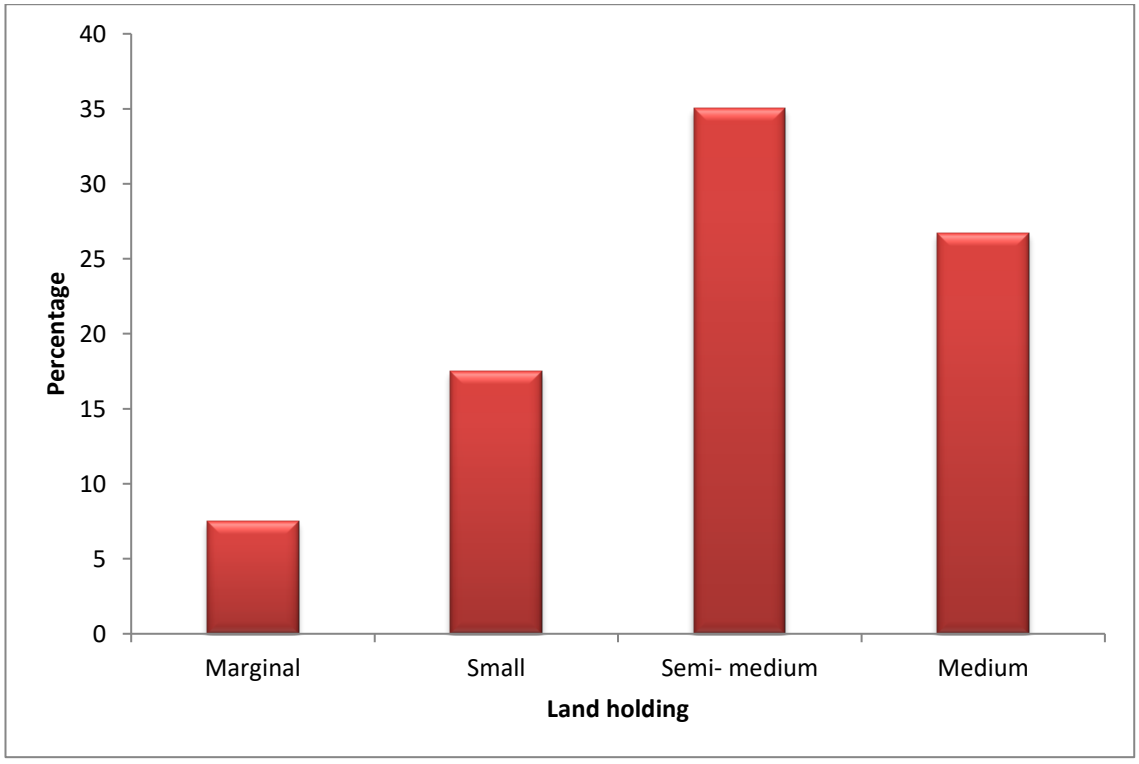

Fig. 7: Distribution of the respondents according to land holding

It was observed from table 9 that, more than one third that is (35.00%) of the respondents was observed in semi-medium category of land holding, followed by (26.67%) respondents were having land holding between 4.01 to 10.00 ha. i.e. medium category. Whereas, (17.50%) of respondents had land holding between 1.01 to 2.00 hectares i.e. small category and (13.33%) respondents comes under large i.e. above 10.00 ha land holding category and (07.50%) of respondents had land holding up to 1.00 ha i.e. marginal category. Thus it could be concluded that, the majority of respondents of the present study were under semi medium (35.00%) & medium (26.67%) land holding respectively.

These findings were similar with the findings of Kale *et al.* (2014) and Hingne (2016) who observed that majority of soybean growers belonged to semi-medium category of land holding & support to the findings of the present study to some extent.

4.1.1.5 Occupation

The occupation of the respondents was studied and the result has been presented in table 10.

Table 10: Distribution of the respondents according to occupation

Sr. No.	Occupation	Respondents (n=120)	
		Number	Percentage
1	Agriculture+ Labour	24	20.00
2	Agriculture	76	63.33
3	Agriculture + Allied occupation	13	10.83
4	Agriculture + Business	02	01.67
5	Agriculture +Service	05	04.17
	Total	**120**	**100.00**

From the distribution given in table 10, it is observed that over half of the respondents (63.33%) had their main occupation agriculture, followed by (20.00%) of the respondents having occupation agriculture + labour and (10.83%) respondents who had occupation agriculture with

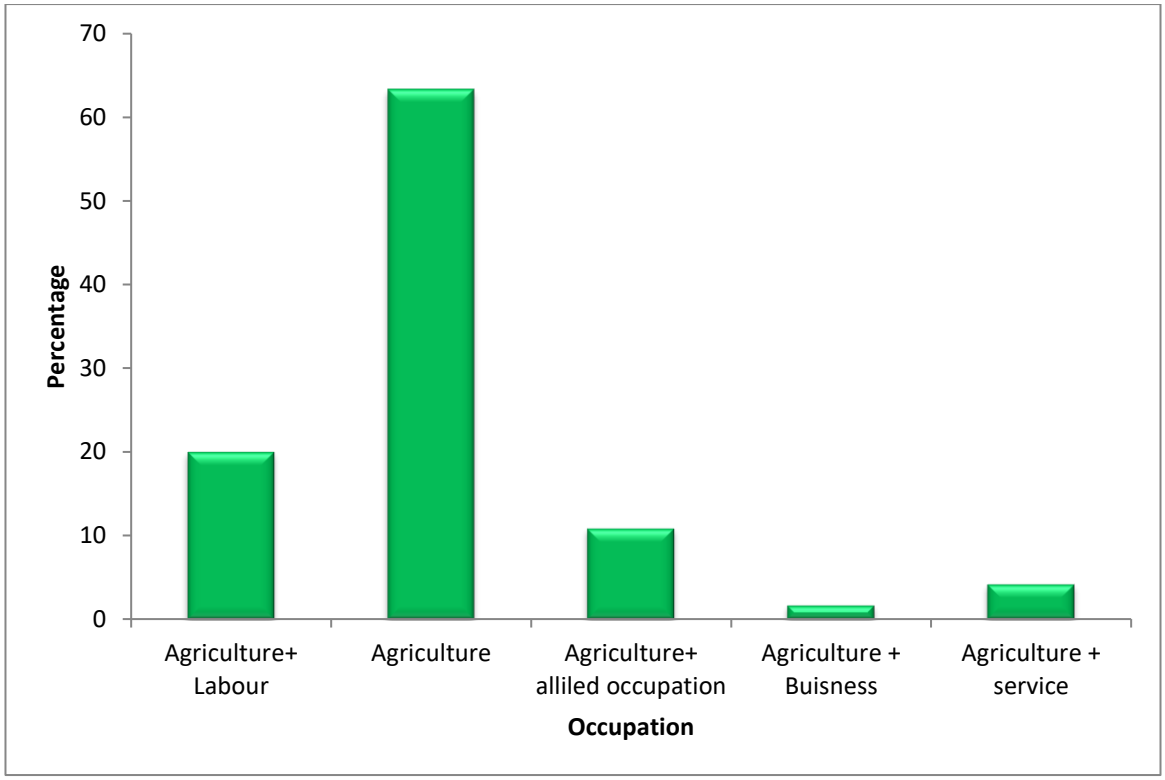

Fig. 8: Distribution of the respondents according to occupation

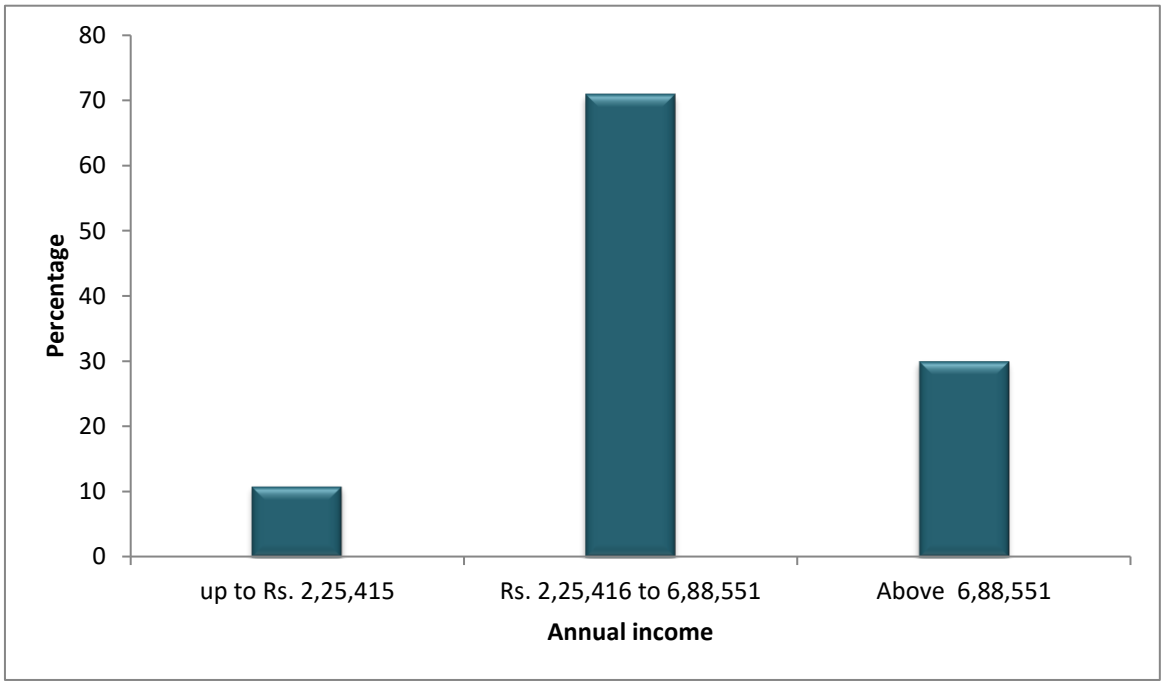

Fig. 9: Distribution of the respondents according to annual income

allied occupation. The respondents who were having occupation agriculture plus service were (04.17%) and agriculture plus business was (01.67%).

The findings of the present study are similar with the findings of Bhandare (2011) and Bhaltilak (2017) who also reported that, the majority of the respondents under their research had agriculture as main occupation.

4.1.1.6 Annual income

Annual income provides availability of capital for farming business. It is assumed that annual income plays an important role for the adoption of integrated weed management practices of soybean growers and was considered for the present study. The results obtained have been presented in table 11.

Table 11: Distribution of the respondents according to annual income

Sr. No.	Annual income (Rs.)	Respondents (n=120)	
		Frequency	Percentage
1.	Up to 2,25,415/-	13	10.83
2.	2,25,416 to 6,88,551/-	85	70.83
3.	Above 6,88,551/-	22	18.34
	Total	**120**	**100.00**

It is evident from table 11 that, majority of the respondents that is (70.83%) were having annual income between Rs. 2,25,416 to 6,88,551/-, it was followed by (18.34%) of the respondents who were having annual income above 6,88,551/- and (10.83%) of respondents have annual income up to 2,25,415/-.

Thus it is concluded that over half of the respondents under the study had annual income ranging from Rs. 2,25,416 to 6,88,551/-.

4.1.1.7 Area under soybean crop

Distribution of the respondents according to their area under soybean crop has been presented in table 12.

Table 12: Distribution of the respondents according to area under soybean crop

Sr. No	Area under soybean	Respondents(n=120)	
		Frequency	Percentage
1	Up to 2.11 ha.	16	13.33
2	2.12 to 5.27 ha.	75	62.50
3	Above 5.27 ha.	29	24.17
	Total	**120**	**100.00**

It is evident from table 12 that, above half of the respondents that are (62.50%) were cultivating soybean crop about 2.12 to 5.27 ha, it was followed by (24.17%) of the respondents who put above 5.27 ha area under soybean crop. Whereas, (13.33%) of the respondents put up to 2.11 ha. area under soybean crop.

It is concluded that majority of the respondents that is 62.50 per cent were cultivating soybean crop between 2.12 to 5.27 ha.

4.1.1.8 Source of information

Every individual seeks information from external sources for building up the confidence & to minimize the risk level, each individual utilize the credible source of information for seeking the needed information from time to time. Keeping in view & to know the type of sources of information utilized by the respondents for seeking the information about IWM practices were studied & the results were drawn in the form of distributional analysis.

The distribution of respondents according to source of information is shown in table 13.

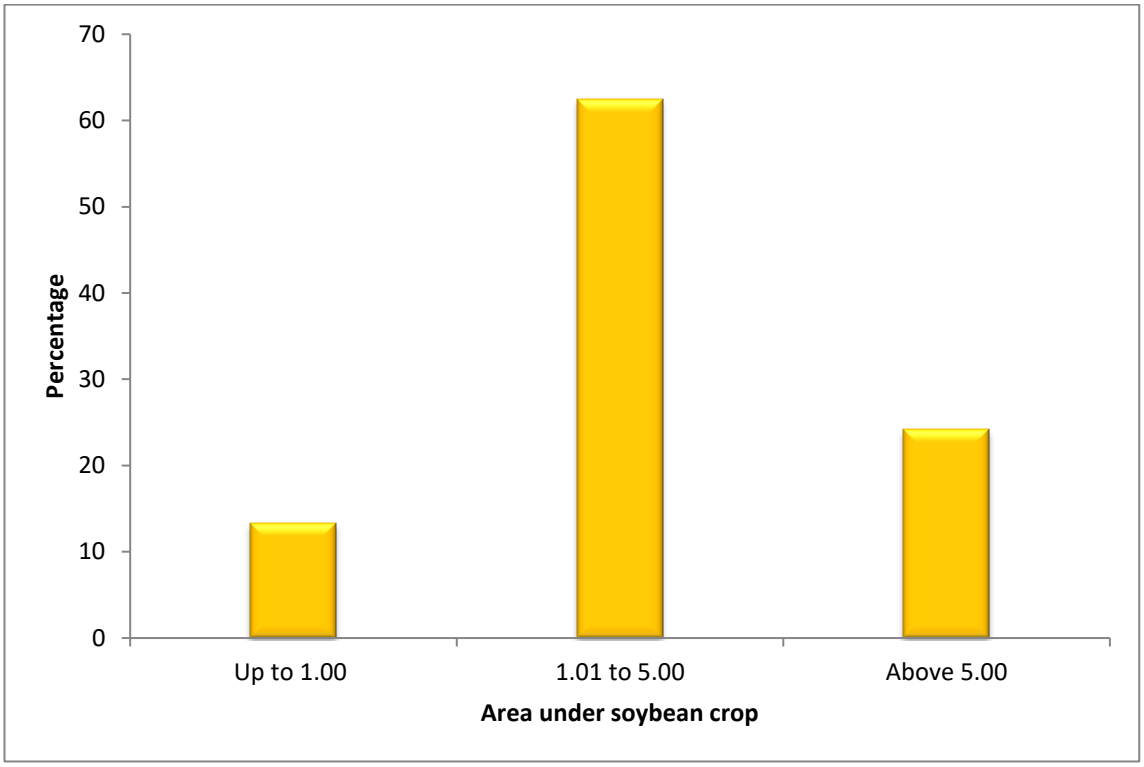

Fig. 10: Distribution of the respondents according to area under soybean crop

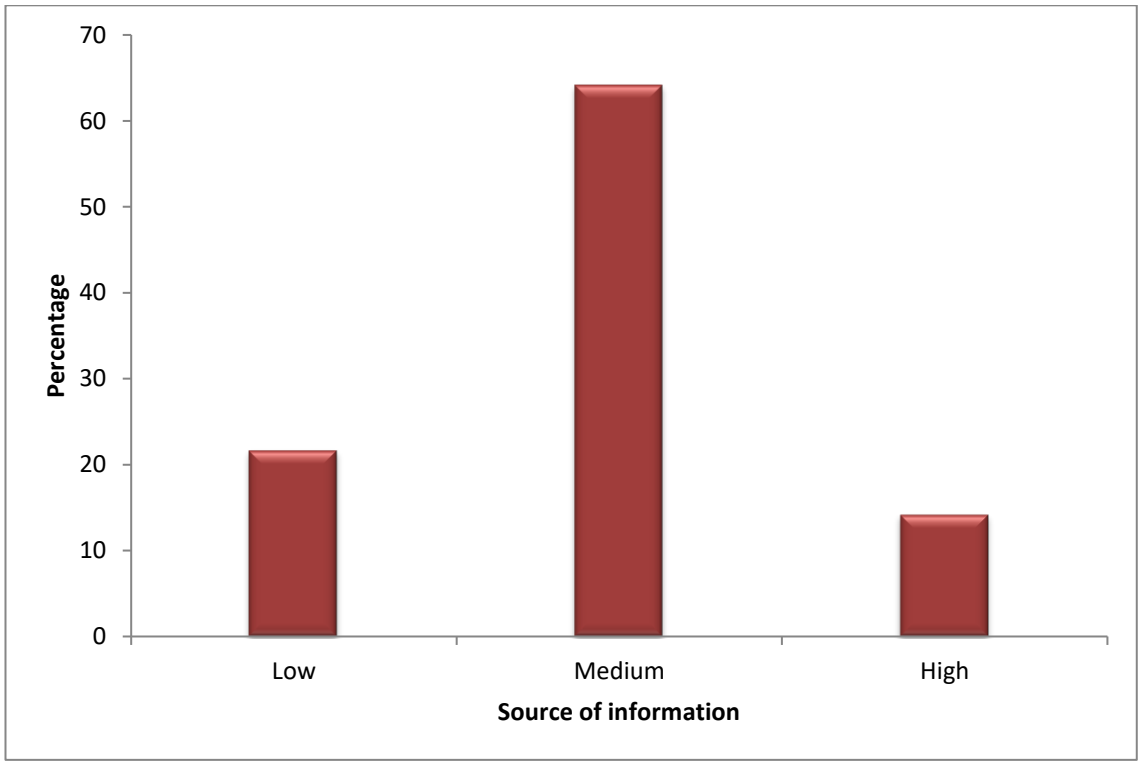

Fig. 11: Distribution of the respondents according to source of information

Table 13: Distribution of respondents according to source of information

Sr. No.	Levels of information sources	Respondents (n=120)	
		Frequency	Percentage
1)	Low (Up to 25)	26	21.67
2)	Medium (26 to 31)	77	64.17
3)	High (Above 31)	17	14.16
	Total	**120**	**100.00**

Mean = 25.86 **S.D = 4.80**

A perusal of table 13 shows that high percentage of the respondents that is (64.17%) were utilizing the sources of information to the medium level, it was followed by (21.67%) of the respondents who were in low level of utilization of information sources. However (14.16%) of the respondents were highly utilizing the sources of information about IWM practices.

Therefore, it is concluded that high percentage of the respondents (64.17%) had medium level access to the different sources of information about IWM practices.

These results were similar to the results earlier reported by Sawale (2011), Atar (2012), Katole *et al.*(2015), Hingne (2016) and Sikarwar, Rahul Singh (2019) that majority of respondent had medium scientific orientation.

The distribution of the respondents according various personal localite sources of information utilized by the soybean growers for seeking information about IWM practices presented in table 15 reveal that, the majority of the respondents were always contacting the neighbors (89.17%), friends (93.33%), progressive farmers (75.00%), Gram Panchayat members (64.17%), relatives (58.33%), and local leaders (50.00%) for seeking information about IWM practices.

Table 14: Distribution of the respondents according to frequency of use of different sources of information

Sr.No	Sources of information	Respondents (n=120)		
A.	**Personal localite sources**	**Always Freq. (%)**	**Sometime Freq.(%)**	**Never Freq. (%)**
1	Neighbors	107 (89.17%)	10 (08.33%)	03 (02.50%)
2	Friends	112 (93.33%)	08 (6.67%)	00 (00.00%)
3	Relatives	70 (58.33%)	28 (23.33%)	22 (18.34%)
4	Progressive farmers	90 (75.00%)	21 (17.50%	09 (07.50%)
5	Gram Panchayat members	77 (64.17%)	18 (15.00%)	25 (20.83%)
6	Local leader	60 (50.00%)	34 (28.33%)	26 (21.67%)
B)	**Personal cosmopolite sources**			
1	Gram Sevak	63 (52.50%)	42 (35.00%)	15 (12.50%)
2	Krishi Sevak	82 (68.33%)	28 (23.33%)	10 (08.34%)
3.	Agricultural Supervisor	04 (3.33%)	12 (10.00%)	104 (86.67%)
4	Agriculture Officer (Talukas)	73 (60.83%)	26 (21.67%)	21 (17.50%)
5	Participation in trainings	20 (16.67%)	32 (26.67%)	68 (56.66%)
6	Participation in group meetings/field days	59 (49.17%)	21 (17.50%)	40 (33.33%)
7	Visit to soybean demonstration plots	12 (10.00%)	27 (22.50%)	81 (67.50%)
8	Visit to Agriculture University	19 (15.83%)	22 (18.33%)	79 (65.84%)
9	Visit to KVK	18 (15.00%)	20 (16.67%)	82 (68.33%)
10	Agro Input Dealer	104 (86.67%)	16 (10%)	00 (00.00%)
11	Study Tour	02 (01.67%)	12 (10.00%)	106 (88.33%)
C)	**Mass media sources**			
1.	Radio	66 (55.00%)	34 (28.33%)	20 (16.67%)
2.	Television	100 (83.33%)	18 (15.00%)	02 (01.67%)
3.	News paper	66 (55.00%)	38 (31.67%)	16 (13.33%)
4.	Farm magazine	07 (05.83%)	52 (43.33%)	61 (50.83%)
5.	Agriculture Exhibition	26 (21.67%)	63 (52.50%)	31 (25.83%)
6	Agro Technology Week	06 (05.00%)	58 (48.33%)	56 (46.67%)

In case of Personal cosmopolite sources majority of respondents stated that they always contact Agro Input Dealer/ Krishi Seva Kendra (86.67%) for acquiring information about weed management, it was followed by Krishi Sevak (68.33%), Agriculture Officer (60.83%) Gram Sevak (52.50%), Participation in group meetings/field days (49.17%), and from whom they seek the information.

The respondent also made it clear that, they have not contacted/ participated in study tour (88.33%) trainings (56.67%) and visit to any soybean demonstration plots (67.50%).The respondents also reported that they sometimes visit to KVK (16.67%), Agriculture supervisor (10.00%), and Agricultural University Scientist (18.33%), for seeking information about IWM practices.

Amongst mass media sources, majority of the respondents expressed that they acquire the information from Audio visual media television (83.33%) by watching farm television programme broadcasted by various TV channels, it was followed by audio media radio (55.00%) through farm radio programs and by print media newspaper (55.00%). The percentage of respondents who sometimes participate in agriculture exhibitions was (21.67%) and (05.83%) of the respondents read farm magazines for getting information about integrated weed management. Near about half of the respondents (48.33%) have sometimes participated in Agro Technology Week organized by the KVK. It might be due to lack of awareness about the importance of Agro technology Week amongst the respondents.

Thus it is concluded that, the respondents are utilizing personal localite, personal cosmopolite sources, and electronic as well as print media as a source of information for acquiring information about IWM practices.

4.1.1.9 Extension contact

Extension contact may play important role for awareness point of view. It is presumed that the farmers having more contacts with

extension workers and other agencies may derive more benefits from developmental agencies and hence it was necessary to study in the present study. Extension contacts of the respondents have been also analyzed and presented in table 15 as follows.

Table 15: Distribution of the respondents according to level of extension contact

Sr. No	Category	Respondents (N=120)	
		Frequency	Percentage
1	Low (up to 6)	31	25.83
2	Medium (7 to 11)	71	59.17
3	High (Above 11)	18	15.00
	Total	**120**	**100.00**

Mean = 8.21 **S.D = 2.70**

The results presented in table 15 indicates that, majority of respondents (59.17%) were in medium category of extension contact followed by (25.83%) of respondents were in low category of extension contact. However (15.00%) of respondents were in high category of extension contact for seeking information about IWM practices.

Thus it is concluded that respondents under the study were in medium category for extension contact.

This finding are in line with the findings earlier reported by Thorat (2013) and Rajshekhar (2015), Hingne (2016) and Waywal (2019) who also observed that majority of respondents had medium category of extension contact.

The individual is likely to use different extension contact about recommended weed management practices.

The frequency extension contacts of the respondents about IWM practices presented in table 16 revealed that, most of the respondents always contact to Sarpanch (85.83%) for seeking information, it was followed by Gramsevak (58.33%) and sometimes they contact with KVK Scientist's (45.83%) followed by Agriculture Extension officer (45.00%) and there are (45.83%) of respondent who never had contact with block

development officer, followed by agricultural university (43.33%)for seeking information about IWM practices.

Table 16: Distribution of respondents according to different type of extension contact

Sr. No.	Extension contact	Respondents n=(120)		
		Always	Sometimes	Never
1	Sarpanch	103 (85.83%)	17 (14.17%)	00 (00.00%)
2	Gram Sevak	70 (58.33%)	33 (27.50%)	17 (14.17%)
3.	Agricultural Extension Officer	39 (32.50%)	54 (45.00%)	27 (22.50%)
4.	Block Development Officer	23 (19.17%)	42 (35.00%)	55 (45.83%)
5.	Agriculture University	34 (28.33%)	34 (28.33%)	52 (43.34%)
6	KVK Scientist	42 (35.00%)	55 (45.83%)	23 (19.17%)
7.	Cell phonic contact	23 (19.17%)	40 (33.33%)	57 (47.50%)

Thus it is concluded that Sarpanch and Gramsevak were the extension contact regularly utilized by the respondents and KVK, scientist as well as Agricultural Extension Officer were sometimes contacted for seeking information about IWM practices.

4.1.1.10 Economic motivation

Distribution of respondents according to their economic motivation was ascertained and data was depicted in table 17

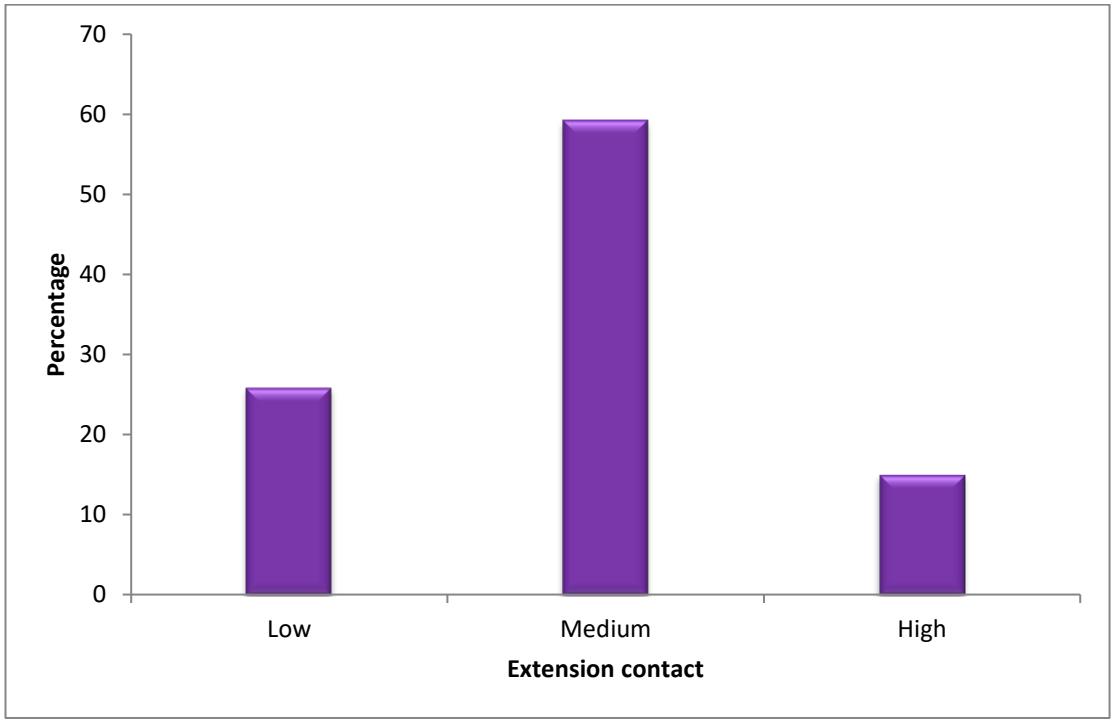

Fig .12: Distribution of the respondents according to their Extension contact

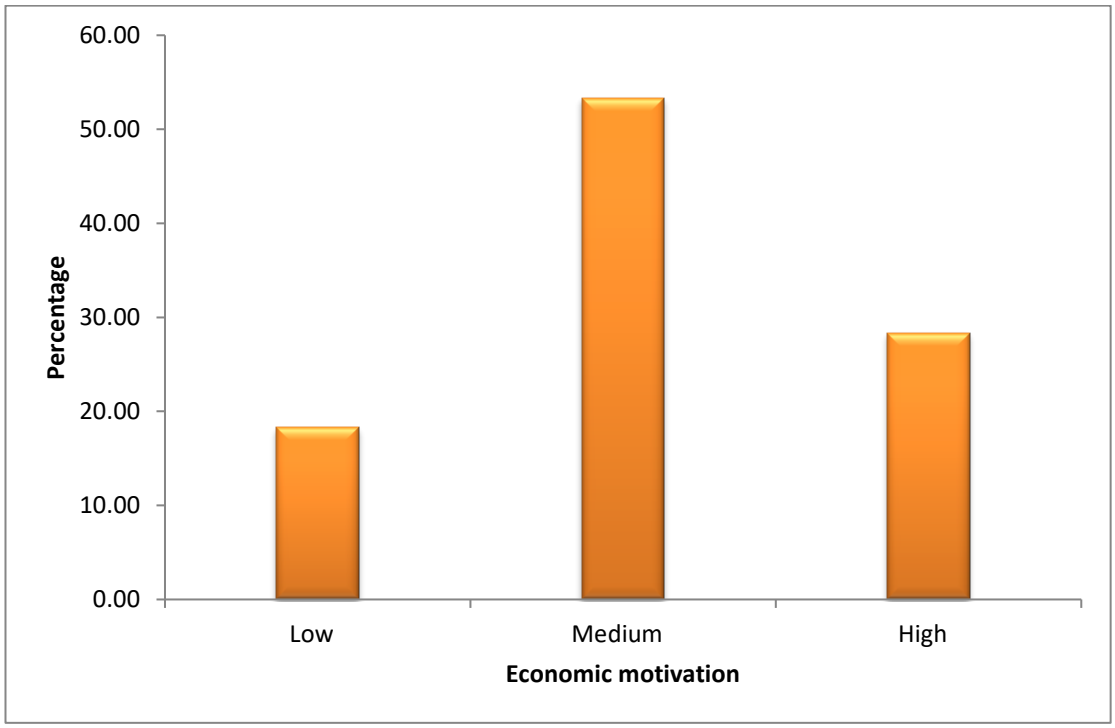

Fig. 13: Distribution of the respondents according to economic motivation

Table 17: Distribution of the respondents according to economic motivation

Sr. No.	Category	Respondents (n=120)	
		Frequency	Percentage
1	Low (Up to 18)	22	18.33
2	Medium (19 to 24)	64	53.33
3	High (Above 24)	34	28.34
	Total	**120**	**100.00**

Mean=21.00 S.D = 3.98

It is observed from table 17 that, (53.33%) of the respondents had medium category of economic motivation, followed by (28.33%) respondents had high category of economic motivation. Only (18.33%) respondents had low category of economic motivation.

A similar finding was observed by Deogirkar (2014), Tekale (2015), Jadhav (2017) who also stated that, majority of soybean growers under their study belonged to medium category of economic motivation.

4.1.1.11 Innovativeness

Table 18: Distribution of respondents according to innovativeness

Sr. No.	Category	Respondents (n=120)	
		Frequency	Percentage
1	Low (Up to 9)	27	22.50
2	Medium (10 to 14)	72	60.00
3	High (Above 14)	21	17.50
	Total	**120**	**100.00**

It is observed from table 18 that more than half of the respondent (60.00%) had medium level of innovativeness followed by (22.50%) of the respondents had low innovativeness and (17.50%) of the respondents had high level of innovativeness.

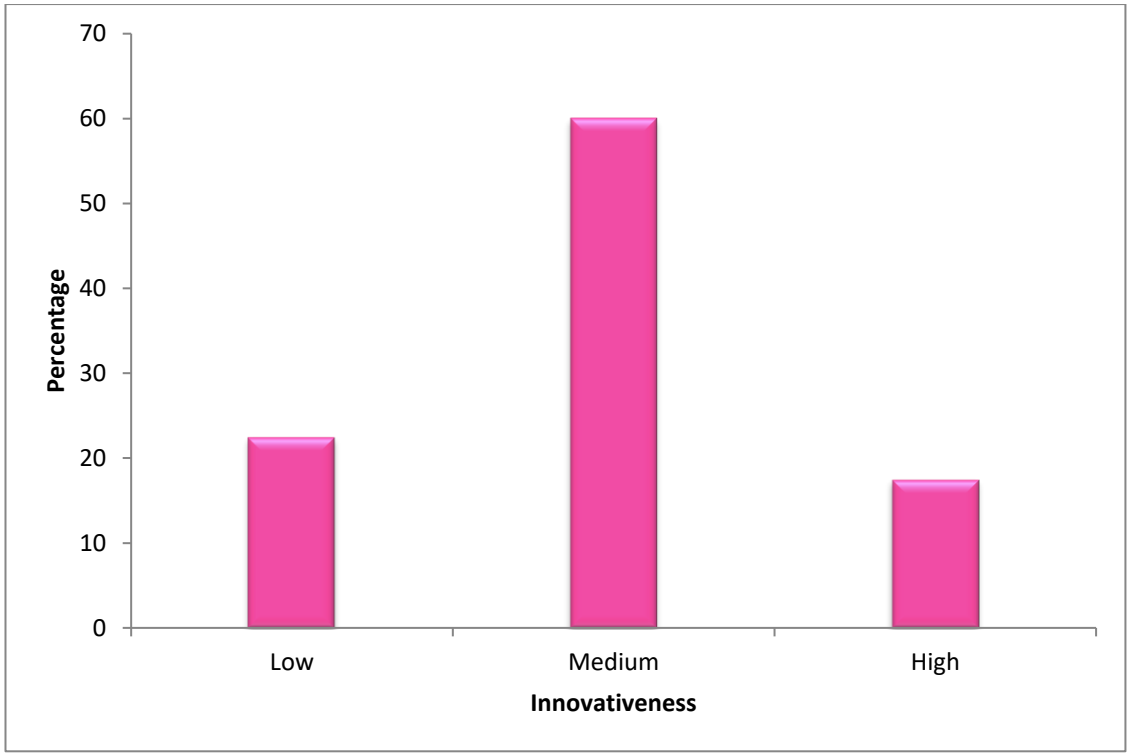

Fig. 14: Distribution of the respondents according to innovativeness

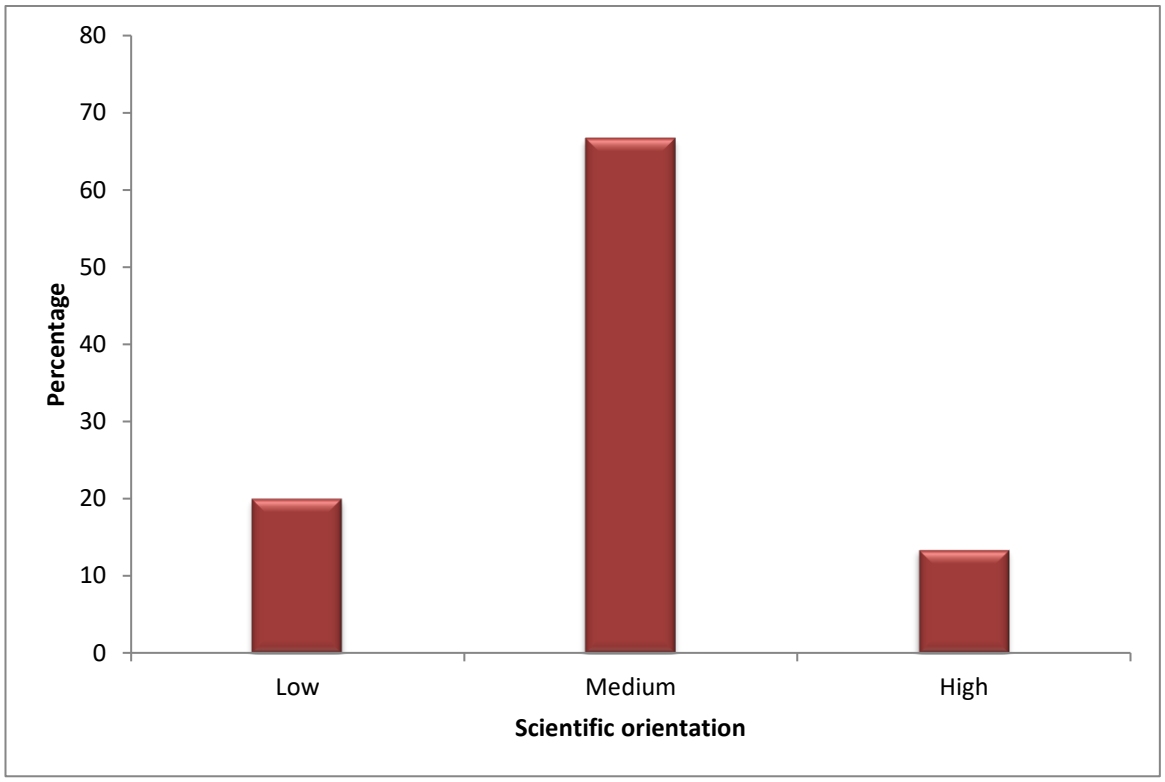

Fig. 15: Distribution of the respondents according to scientific orientation

These findings are similar with Gudhale (2015), Rajshekhar (2015) who also reported that majority of the respondents had medium innovativeness.

4.1.1.12 Scientific orientation

Table 19: Distribution of respondents according to scientific orientation

Sr. No.	Category	Respondents (n=120)	
		Frequency	Percentage
1	Low (Up to 18)	24	20.00
2	Medium (19 to 24)	80	66.67
3	High (Above 24)	16	13.33
	Total	**120**	**100.00**

From table 19 it is observed that majority of the respondents (66.67%) possessed medium level of scientific orientation followed by (20.00%) of the respondents had low scientific orientation and (13.33%) of the respondents had high scientific orientation.

These findings are similar in line with Singh Shivpal (2015), Tayade (2016) who had reported that majority of the respondents belonged to medium category of scientific orientation.

4.1.1.13 Knowledge about Integrated Weed Management Practices

Table 20: Distribution of respondents according to their level of knowledge about IWM practices

Sr. No.	Category	Respondents (n=120)	
		Frequency	Percentage
1	Low (Up to 33.33)	08	06.67
2	Medium (33.34 to 66.66)	62	51.67
3	High (Above 66.66)	50	41.66
	Total	**120**	**100.00**

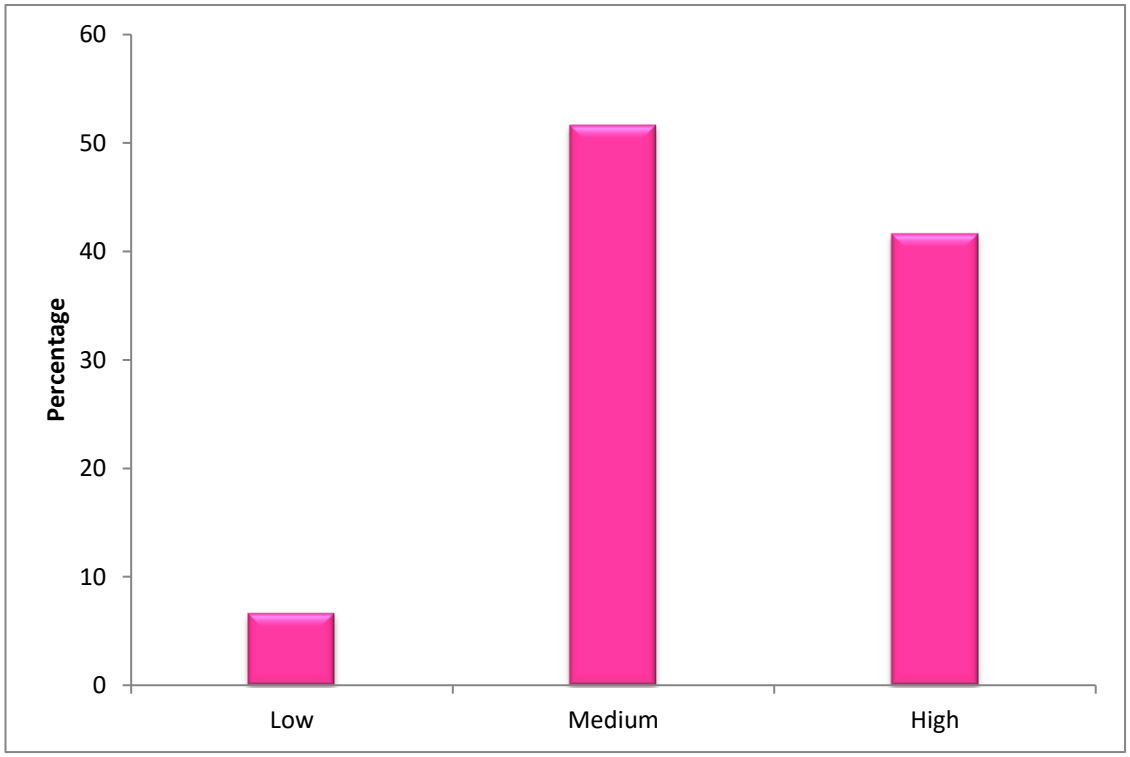

Fig. 16: Distribution of the respondents according to knowledge about integrated weed management practices by soybean growers.

It was observed from table 20 that, more than half of the respondents (51.67%) were observed in medium level of knowledge about IWM practices in soybean. It was followed by the respondents (41.67%) who had high level of knowledge and remaining (06.67%) of the respondents who were noted to be in low level knowledge. The low level knowledge group might be the non-adopters who were not following IWM practices in soybean crop.

The findings thus conclude that majority of the respondents (51.67%) had medium level followed by the respondents (41.67%) had high level of knowledge about selected IWM practices.

These findings are similar with the findings earlier reported by Deogirkar (2015), Anuradha Ranjan Kumari *et al.* (2020) who also noted that majority of respondents had medium level of knowledge about IWM practices followed by high level of knowledge.

The knowledge about recommended practices to be followed for IWM possessed by respondents depicted in table 21 reveal that, per cent of the respondents (95.83%) were completely holding the knowledge about sowing time. Respondents having knowledge about crop rotation and hoeing were (75.00%) and (88.33%) respectively. As regards the knowledge about time of hoeing followed first at 20 DAS, second at 30 DAS it was observed that (84.17%) and (80.00%) of the respondents respectively. Respondents holding the knowledge about irrigation management were (80.83%). Whereas per cent of the respondents holding knowledge about farm hygiene and use of uncontaminated seeds for sowing was (83.33%) and (71.67%) respectively. 61.67 per cent of the respondents knew about balance use of fertilizer. Regarding the knowledge about intercropping of soybean plus tur and soybean plus sorghum was (60.00%) and (17.50%) respectively. However it was strange to know that only 17.50 per cent were possessing knowledge about the intercropping of soybean with sorghum.

Table 21: Distribution of respondents according to practice wise knowledge about Integrated Weed Management practices

Sr. No.	Integrated weed management practices	Respondents (n= 120)		
		Frequency		Per cent (Yes)
		Yes	No	
A	**knowledge about Preventive weed management practices**			
1	Sowing time	115	05	95.83
2	Crop rotation	90	30	75.00
3	Use of Hoeing	106	14	88.33
4	**Time of hoeing**			
4.1	First at 20 DAS	101	19	84.17
4.2	Second at 30 DAS	96	24	80.00
5	Irrigation management	97	23	80.83
6	Farm hygiene	100	20	83.33
7	Use of uncontaminated seeds for sowing.	86	34	71.67
8	Balance use of fertilizer (RDF)	74	46	61.67
9	**Intercrops**			
9.1	Soybean + Tur	72	48	60.00
9.2	Soybean + Sorghum	21	99	17.50
B	**Do you have knowledge about mechanical weed control?**			
1	Ploughing	111	09	99.17
2	Harrowing	116	04	96.67
3	Use of hand weeding			
3.1	One at 25 DAS	107	13	89.17
3.2	One at 45 DAS	96	24	80.00
4	Inter-cultivation through different farm implements	86	34	71.67
5	Cleaning of machinery to prevent spread of weeds	99	21	82.50

C	**Do you have knowledge about chemical weed control?**			
1	Knowledge about name of recommended herbicide used for soybean	93	27	77.50
2	Knowledge about recommended per ha. dose of herbicide	65	55	54.17
3	Time of herbicide application (pre emergence/post emergence)	80	40	66.67
4	Use appropriate recommended doses	70	50	58.33
5	Use of pre sowing herbicide (Fluchloralin 45 EC.)	39	81	32.50
6	Use of pre emergence herbicide (Eg. Pendamethalin)	61	59	50.83
7	Use of post emergence herbicide (Eg. Imazethapyr)	107	13	89.17
8	Knowledge about sufficient moisture in soil during herbicide application	96	24	80.00
9	Knowledge about types of spray pump used for spraying herbicide (knapsack spray pump)	86	34	71.67
10	Knowledge about types of nozzle used for herbicide application in soybean (Flat fan /flood jet type nozzle)	62	58	51.67
11	**Precautions while using herbicide:-**			
11.1	Read the label before use	105	15	87.50
11.2	Wear goggles, rubber gloves before handling and use of chemicals	84	36	70.00
11.3	Knowledge about herbicide spraying during high speed wind and cloudy weather	102	18	85.00
11.4	Use of clean water for herbicide application.	97	23	80.83
11.5	Herbicide kept in a safe place	107	13	89.17
11.6	Dispose of empty containers	95	25	79.17
12	Knowledge about separate sprayer to be used for herbicide application	91	29	75.83
13	Knowledge about intercultural operation within 4-5 days after herbicide application	101	19	84.17

The knowledge about mechanical weed control presented in 'B' section of table 21 reveal that, majority of respondents were holding knowledge about weed control through the operation ploughing (99.17%), harrowing (96.67%) and inter cultivation through blade harrow or deshi plough (71.67%). However it was also noticed that (82.50%) of the respondents were holding the knowledge about cleaning of machinery for preventing the spread of weeds.

The knowledge about chemical weed control methods reveal that (77.50%) of the respondents were completely aware about name of recommended herbicide used for soybean. The knowledge about present of sufficient moisture in soil during application of herbicide was (80.00%). And regards knowledge about types of spray pump to be used for spraying herbicide, it was observed that 71.67 per cent of respondents were having knowledge of using knapsack sprayer for spraying to get the optimum results of herbicides.

Further it was observed that 54.17 per cent of the respondents were holding knowledge about recommended per ha. dose of herbicides to be used for soybean along their technical and brand names. Knowledge regarding use of pre sowing herbicide (Fluchloralin 45 EC) and use of pre emergence herbicide (Pendamethalin) was (32.50%) and (50.83%) respectively. As regards names of post emergence herbicides (Imazethyper) to be applied for soybean crop and types of nozzles viz. flat fan/flood jet type nozzles to be used for spraying of herbicides in soybean, (89.17%) and (51.67%) of the respondents respectively possessed the required knowledge.

The knowledge about precautions to be taken while using herbicides reveal that majority of respondents had knowledge about herbicide spraying during high speed wind and cloudy weather (85.00%), herbicides to kept in safe place (89.17%), use clean water for spraying of herbicides (80.83%), disposing the empty container after use of herbicides (79.17%), inter culture operation with 4-5 days after application of herbicides (84.17%) and (87.50%) is category of respondents were having knowledge about reading the label before use herbicide and to use separate spray

pump for application of the herbicides. The precautions to be taken during spraying of herbicides viz. wearing goggles, using rubber gloves while handling chemicals was also known to the (70.00%) of the respondents. Thus it could be concluded that majority of the respondents were holding sound knowledge about precautions to be taken while handling and making use of the herbicides.

4.1.2 Distribution of the respondents according to adoption about integrated weed management practices by soybean growers.

The adoption level of IWM practices was studied and the category wise distribution of the respondents is given in table 22

Table 22: Distribution of the respondents according to level of adoption of IWM practices

Sr. No.	Adoption index	Respondents (n=120)	
		Frequency	Percentage
1	Low (Up to 33.33)	24	20.00
2	Medium (33.34 to 66.66)	83	70.00
3	High (Above 66.66)	13	10.00
	.Total	**120**	**100.00**

The adoption of IWM practices in soybean crop presented in table 22 indicates that, majority of the respondents (70.00%) had medium level of adoption followed by (20.00%) respondents who had low level of adoption. Only (10.00%) respondents had high level of adoption for following IWM practices in soybean crop. Thus, it is concluded that over three fourth (70.00%) of the respondents had medium level adoption for IWM practices in soybean crop.

Similar finding was observed by Ashish Kumar (2012), Mohite (2013), who stated that more than half of the respondents had medium level of adoption.

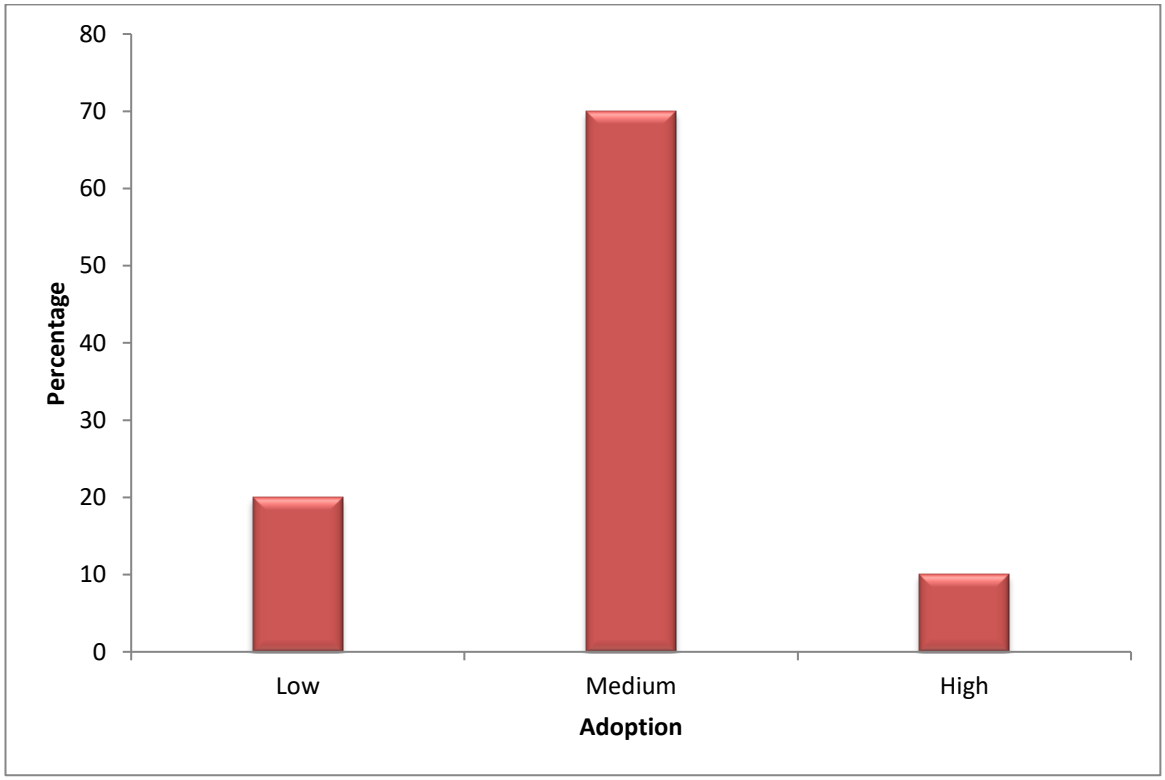

Fig. 17: Distribution of the respondents according to adoption about integrated weed management practices by soybean growers.

Table 23: Distribution of respondents according to practice wise adoption of IWM practices

Sr. no.	Integrated weed management practices	Respondents n=120		
		Complete	Partial	No Adoption
A	**Do you adopt preventive Weed Management practices**			
1	sowing time	98 (81.67%)	20 (16.67%)	02 (01.66%)
2	Crop rotation	17 (14.17%)	60 (50.00%)	43 (35.83%)
3	Use of Hoeing	73 (60.83%)	35 (29.17%)	12 (10.00%)
4	**Time of hoeing**			
4.1	First at 20 DAS	85 (70.83%)	28 (23.33%)	07 (05.84%)
4.2	Second at 30 DAS	32 (26.67%)	70 (58.33%)	18 (15.00%)
5	Irrigation management	60 (50.00%)	41 (34.67%)	19 (15.83%)
6	Farm hygiene	70 (58.33%)	38 (31.67%)	12 (10.00%)
7	Use of uncontaminated seeds for sowing.	58 (48.33%)	27 (22.50%)	35 (29.17%)
8	Balance use of fertilizer (RDF)	31 (25.83%)	40 (33.33%)	49 (40.84)
9	**Intercrops**			
9.1	Soybean + Tur	37 (30.83%)	09 (07.50%)	74 (61.67%)
9.2	Soybean + Sorghum	00 (00.00%)	00 (00.00%)	00 (00.00%)

Sr. no.	Integrated weed management practices	Respondents n=120		
		Complete	Partial	No Adoption
B	**Do you adopt mechanical weed control?**			
1	Ploughing	120 (100.00%)	00 (00.00%)	00 (00.00%)
2	Harrowing	84 (70.00%)	34 (28.33%)	02 (01.67%)
3	Use of hand weeding			
3.1	One at 25 DAS	100 (83.33%)	12 (10.00%)	08 (06.67%)
3.2	One at 45 DAS	48 (40.00%)	46 (38.33%)	26 (21.67%)
4	Inter-cultivation through different farm implements	31 (25.83%)	54 (45.00%)	35 (29.17%)
5	Cleaning of machinery to prevent spread of weeds	11 (09.17%)	69 (57.50%)	40 (33.33%)
C	**Do you adopt chemical weed control?**			
1	Use of different herbicide	100 (83.33%)	20 (16.67%)	00 (00.00%)
2	Use of recommended per ha. dose of herbicide	116 (96.67%)	00 (00.00%)	04 (03.33%)
3	Time of herbicide application (pre emergence/post emergence)	37 (30.83%)	82 (68.33%)	01 (00.83%)
4	Use appropriate recommended doses	11 (09.17%)	42 (35.00%)	67 (55.83%)
5	Use of pre sowing herbicide (Eg. Fluchloralin 45 EC.)	03 (02.50%)	12 (10.00%)	105 (87.50%)
6	Use of pre emergence herbicide (Eg. Pendamethalin)	60 (50.00%)	40 (33.33%)	20 (16.67%)

Sr. no.	Integrated weed management practices	Respondents n=120		
		Complete	Partial	No Adoption
7	Use of post emergence herbicide (Eg. Imazethapyr)	110 (91.67%)	02 (01.67%)	08 (06.67%)
8	Application of herbicide when sufficient moisture in present in soil	60 (50.00%)	40 (33.33%)	20 (16.67%)
9	Types of spray pump used for spraying herbicide (knapsack spray pump)	80 (66.67%)	08 (06.67%)	32 (26.66%)
10	Types of nozzle used for herbicide application in soybean(Flat fan /flood jet type nozzle)	27 (22.50%)	35 (29.17%)	58 (48.33%)
11	**Precautions while using herbicide**			
11.1	Read the label before use	67 (55.83%)	04 (03.33%)	49 (40.84%)
11.2	Wear goggles, rubber gloves before handling and use of chemicals	20 (16.67%)	08 (06.67%)	92 (76.66%)
11.3	Avoid herbicide spraying during high speed wind and cloudy weather	73 (60.83%)	08 (06.67%)	39 (32.50%)
11.4	Use of clean water for herbicide application.	83 (69.17%)	00 (00.00%)	37 (30.83%)
11.5	Herbicide kept in a safe place	87 (72.50%)	00 (00.00%)	33 (27.50%)
11.6	Dispose of empty containers	75 (62.50%)	00 (00.00%)	45 (37.50%)
12	Use of separate sprayer for herbicide application	22 (18.33%)	00 (00.00%)	98 (81.67%)
13	Intercultural operation not taken within 4-5 days after herbicide application	60 (50.00%)	25 (20.83%)	35 (29.17%)

The practice wise adoption of IWM practices followed by the respondents given in table 23 reveal that the adoption of cultural practice sowing of soybean at proper time was adopted by (81.67%) of the respondents and other preventive practice crop rotation in soybean was partially adopted by (50.00%) of the respondents. The use of hoeing was completely adopted by (60.83%) per cent of the respondents. The time of hoeing to be followed first at 20 DAS and 30 DAS was followed by completely adopted (70.83%) and partially adopted (58.33%) of the respondents respectively. The adoption of irrigation management was (50.00%) of the respondents. However half of the respondents who were not adopting the irrigation management might due to the reason of poor irrigation water sources and inadequate rainfall. Also farm hygiene and use of uncontaminated seeds for sowing was adopted by 58.33 per cent and 48.33 per cent of the respondents respectively. Poor adoption of farm hygiene and seed hygiene might be due to unawareness of its loss. However it was observed that, the operation balance use of fertilizer was never adopted by 40.84 per cent of the respondents respectively.

The inter crop sowing along soybean crop reveal that, 30.83 per cent of the respondents were adopting soybean+tur crop method in 1:1 ratio, Soybean+ sorghum was not adopted by any of the respondent.

The adoption of mechanical practices presented in ‘B’ section of table 23 reveal that the operation ploughing, harrowing, Inter-cultivation through blade harrow or deshi plough was completely adopted by 100.00 per cent, 70.00 per cent and 25.83 per cent of the respondents respectively. Whereas it was also observed that, the important practice cleaning of machinery to prevent spread of weeds was partially adopted by 57.50 per cent of the respondents. The use of hand weeding first at 25 DAS and second at 45 DAS was completely adopted by 83.33 per cent and 40.00 per cent of the respondents respectively. Low adoption of weeding operations at 45 DAS might be due to the reason that during peak period there may be scarcity of inputs or labor which deprive them from complete adoption of these practices.

The adoption of chemical practices given in ‘C’ section of table 23 show that, 50.00 per cent of the respondents were applying the herbicides when sufficient moisture is present in the soil. It was followed by use of different herbicides, use of post emergence herbicide (Eg.Imazithapyr) and type of spray pump to be used by spraying herbicides was completely adopted by 83.33 per cent, 91.67 per cent 66.67 per cent of each the respondents respectively. Further it was observed that, time of application i.e. pre emergence and post emergence herbicides and use of recommended per hectare dose of herbicides was partially adopted by 68.33 per cent and completely adopted by 96.67 per cent of the respondents respectively. Further it was observed that, use of appropriate and recommended doses of herbicides was not adopted by 55.83 per cent of the respondents, whereas 87.50 per cent and 48.33 per cent of the respondents were not adopting use of pre sowing and pre emergence herbicides respectively.

The adoption of specific type of nozzle to be used for spraying herbicide was adopted by 22.50 per cent and use of different type of spray pump was adopted by 66.67 per cent of the respondents respectively.

The results pertaining to take precautions while using herbicides indicated that 69.17 per cent and 72.50 per cent of the respondents were completely adopting clean water for spraying and keeping the herbicides at safe place respectively. It was followed by 62.50 per cent, 60.83 per cent, 55.83 per cent and 50.00 per cent of respondents were completely adopting disposal of the containers after use, avoiding spraying during high wind speed and cloudy weather, reading of label before use and following inter culture operation within 4-5 days after herbicide application respectively. However it was also observed that, 81.67 per cent and 76.67 per cent of the respondents were not using separate spray pumps for spraying herbicides and not using goggle, wearing rubber gloves before handling and use of chemicals respectively.

Thus it concluded that the gap exists in possessed knowledge by the respondents about recommended IWM practices and the practices actually adopted by the respondents for control of weeds in soybean crop.

4.2 Relational analysis

4.2.1 Relational analysis of independent variables with dependent variables

With the view to find out the relationship of the selected personal, socio-economic, situational, communication, psychological characteristics of soybean growers with their adoption of IWM practices in soybean crop. In order to find out the correlates of adoption the coefficient of correlation was worked out and the results obtained are has been presented as below.

Table 24: Correlation coefficient of selected characteristics of the respondents with their adoption

Sr. No.	Characteristics	Coefficient of correlation 'r' value
1	Age	-0.047
2	Education	0.339**
3	Family size	-0.116
4	Land holding	0.186*
5	Occupation	0.319**
6	Annual income	0.217*
7	Area under soybean crop	0.167*
8	Sources of information	0.239**
9	Extension contact	0.264**
10	Economic motivation	0.359**
11	Innovativeness	0.189*
12	Scientific orientation	0.305**
13	Knowledge	0.510**

** - Significant at 0.01 level of probability

* - Significant at 0.05 level of probability

It could be seen from table 24 that, among selected variables education, occupation and source of information, extension contact, economic motivation, scientific orientation and knowledge was positively and significantly correlated with adoption at 0.01 per cent level of probability. However the variables land holding, annual income, area under soybean crop and innovativeness was positive and significant with adoption of the respondents at 0.05 per cent level of probability. So the null hypothesis (H_0) was rejected.

The variable age and family size was negative and non-significant with the adoption of the respondents. The null hypothesis (H_0) was therefore accepted.

The results of correlation coefficient (r) derived from the table showed as below.

4.2.1.1 Age and adoption

The data of the results of the present study clearly explained that the correlation coefficient indicates that age of the respondents was found negatively non-significant correlated with adoption of IWM practices.

It can be visualize from the data that age of respondents was negatively correlated with adoption of the respondents. Obviously the young farmers are more prone to change. The complete utilization of their physical strength and mental strength enables them to perform in more innovative way.

Similar findings were also reported by Barkade (2015) who had reported negative relationship between age and adoption.

4.2.1.2 Education and adoption

The data of results of the present study clearly explained that the correlation coefficient showed positive and highly significant relationship between the education of the respondents and their adoption of IWM practices.

The level of education also helps to an individual to get himself acquainted with the skill that are required for undertaking the

improved techniques of agriculture. This might be resulted in establishing a positive and highly significant relationship of education with adoption.

The similar finding was also reported by Deogirkar (2014) and Barkade (2015).

4.2.1.3 Family size and adoption.

It was noted in the results of the study that the correlation coefficient showed negative and non-significant relationship between the family size of the respondents and their adoption of IWM practices.

If the size of family increased this might be increase expenditure for their livelihood resulted in establishing a negative relationship with annual income and decrease in annual income cause unavailability of finance for adoption of IWM practices.

These finding supported by Barkade (2015) who also reported that negative and non-significant relationship of family size and adoption.

4.2.1.4 Land holding and adoption.

It was noticed in the results of present study that the correlation coefficient showed positively and significantly relationship between the land holding of the respondents and their adoption of IWM practices.

It can be inferred from these findings that farmers who had more land holding leads to increase in their annual income so as they can easily afford costly herbicide for better farming due to which land holding might be established positive and significant relationship with adoption.

The similar finding was also reported by Deshmukh (2011), Barkade (2015), Hingne (2016).

4.2.1.5 Occupation and adoption

It was revealed from results of the present study that the correlation coefficient seen the positive and highly significant correlation between occupation of the respondents and their adoption of IWM practices.

It can be determined from the present study that occupation determines the socio economic status of the respondents which brought him into adoption of various technologies including IWM practices.

4.2.1.6 Annual income and adoption

It was noticed in the results of present study that the correlation coefficient showed positively and significantly relationship between the annual income of the respondents and their adoption of IWM practices.

From this result it can be said that the annual income determines the economic status of the respondents. This clearly indicates that higher the annual income, higher the level of adoption. Annual income of the respondents therefore, could establish positive and significant relationship with adoption.

These findings were similar with Barkade (2015), Tayade (2016) who also established the positive and significant relationship between annual income and adoption.

4.2.1.7 Area under soybean crop and adoption.

It was portrayed in the study that the correlation coefficient indicated positive and significant relationship between area under soybean crop and adoption. In general individual having more area under crop have greater access for adoption of weed management practices.

The similar finding was also reported by Mohite (2013), Deogirkar (2014), Barkade (2015), Tayade (2016).

4.2.1.8 Source of information and adoption

It was revealed from results of the present study that the correlation coefficient described the positive and highly significant relationship between sources of information of the respondents and their adoption of IWM practices. .

It clearly indicates that, due to information media viz. television, radio, newspaper respondents came to know new IWM practices in farming. There sources of information also provides themselves

confidence and ability to take better decisions. As they got information, they were enough confident and were able to adopt, once benefited, they could again bring them in adoption. Thus the source of information increases adoption level.

This finding was supported by Atar (2012), Lad (2013), Tayade (2016).

4.2.1.9 Extension contact and adoption

It was noticed in the results of present study that the correlation coefficient showed positive and highly significant relationship between extension contact and adoption.

It is obvious that making contact with extension personnel increase level of knowledge which probably leads to increase in their adoption. It might be the reason that extension contact could express the positive and highly significant relationship these two variables.

This finding is in line with findings Tayade (2016), Hingne (2016) and Waywal (2019).

4.2.1.10 Economic motivation and adoption

It was noticed in the results that coefficient correlation showed positive and highly significant relationship between economic motivation and adoption.

The assessment of economic motivation increases the farmers will to create wealth and with that concern he adopt new practices including IWM practices to make worth his efforts and achieve more benefit.

Similar observations were recorded by Tekale (2015), Hingne (2015) and Jadhav (2017).

4.2.1.11 Innovativeness and adoption

It was noticed in the results that coefficient correlation showed positive and highly significant relationship between innovativeness and adoption.

Innovativeness accelerates the farmers to try out new ideas in farming and also build self-confidence. Innovativeness gives a framework to act on same things in a better way. It is therefore established a positive and significant relationship with adoption.

These findings are similar with findings Tayade (2016), Bhaltilak (2017).

4.2.1.12 Scientific orientation and adoption

It was noticed in the results that coefficient correlation showed positive and highly significant relationship between scientific orientation and adoption.

Farmer's scientific orientation put them to know importance of science developed in field of agriculture which creates innovativeness among them. It is therefore scientific orientation established a positive and significant relationship with adoption. This finding is in line with findings Singh Shivpal (2015), Tayade (2016), Sikarwar, Rahul Singh (2019).

4.2.1.13 Knowledge and adoption

It was noticed in the results that coefficient correlation showed positive and highly significant relationship between knowledge and adoption. In process of innovation it is obvious that the rate of adoption depend on level of knowledge. Farmers who possessed more knowledge probably have more adoption.

These results are similar with the findings of Deogirkar (2014), Waywal (2019).

4.3 Constraints analysis

4.3.1 Constraints faced in adoption of integrated weed management in soybean.

Constraints faced by the respondents in adoption of integrated weed management practices were recorded while collecting the data and the constraints which were found important are depicted in table 25.

The constraints recorded and presented in table 25 reveal that cent-per cent (100%) each of the respondents were facing the constraints viz. higher cost of herbicides, load shedding and problem of wild animals respectively, it was followed by lack of technical guidance (85.00%), inadequate supply of irrigation water in annual cropping system (76.67%), inadequate supply of labour for hand weeding (84.17%), lack of knowledge about use appropriate dose of herbicide (55.83%), lack of proper information about chemical weed control (62.50%), problems regarding financial sources were faced by (56.67%), rains after spray hampers the effect of herbicide were faced by (65.83%) and also observed that lack of knowledge and adoption about precautions taking while spraying was (35.83%) are some of the major constraints faced by the respondents.

Table 25: Distribution of the respondents according to constraints faced in adoption of integrated weed management practices in soybean

Sr. No.	Constraints	Respondents (120)	
		Frequency	Per cent
1	Cost of herbicides is high	120	100.00
2	load shedding	120	100.00
3	Devastation from wild animal	120	100.00
4	lack of technical guidance	102	85.00
5	Inadequate supply of water in annual cropping system	92	76.67
6	Inadequate supply of labour for hand weeding	101	84.17
7	lack of knowledge about use appropriate dose of herbicide	67	55.83
8	lack of proper information about chemical weed control	75	62.50
9	Non-availability of money at proper time.	68	56.67
10	Rains after spray hampers the effect of herbicide/insecticide	79	65.83
11	Lack of knowledge about precautions taking while spraying	43	35.83

On the parallel line Deogirkar (2014), Tayade (2015) and Waywal (2019) reported the same major constraints.

4.4 Empirical model of study

Considering the empirical relations amongst the independent variables and dependent variables the empirical model was prepared and relationship has been depicted in figure. The empirical model shows that the observed relationship of independent variable age, education, family size, land holding, annual income, area under soybean crop, source of information, extension contact, economic motivation, innovativeness, scientific orientation and knowledge and dependent variable adoption.

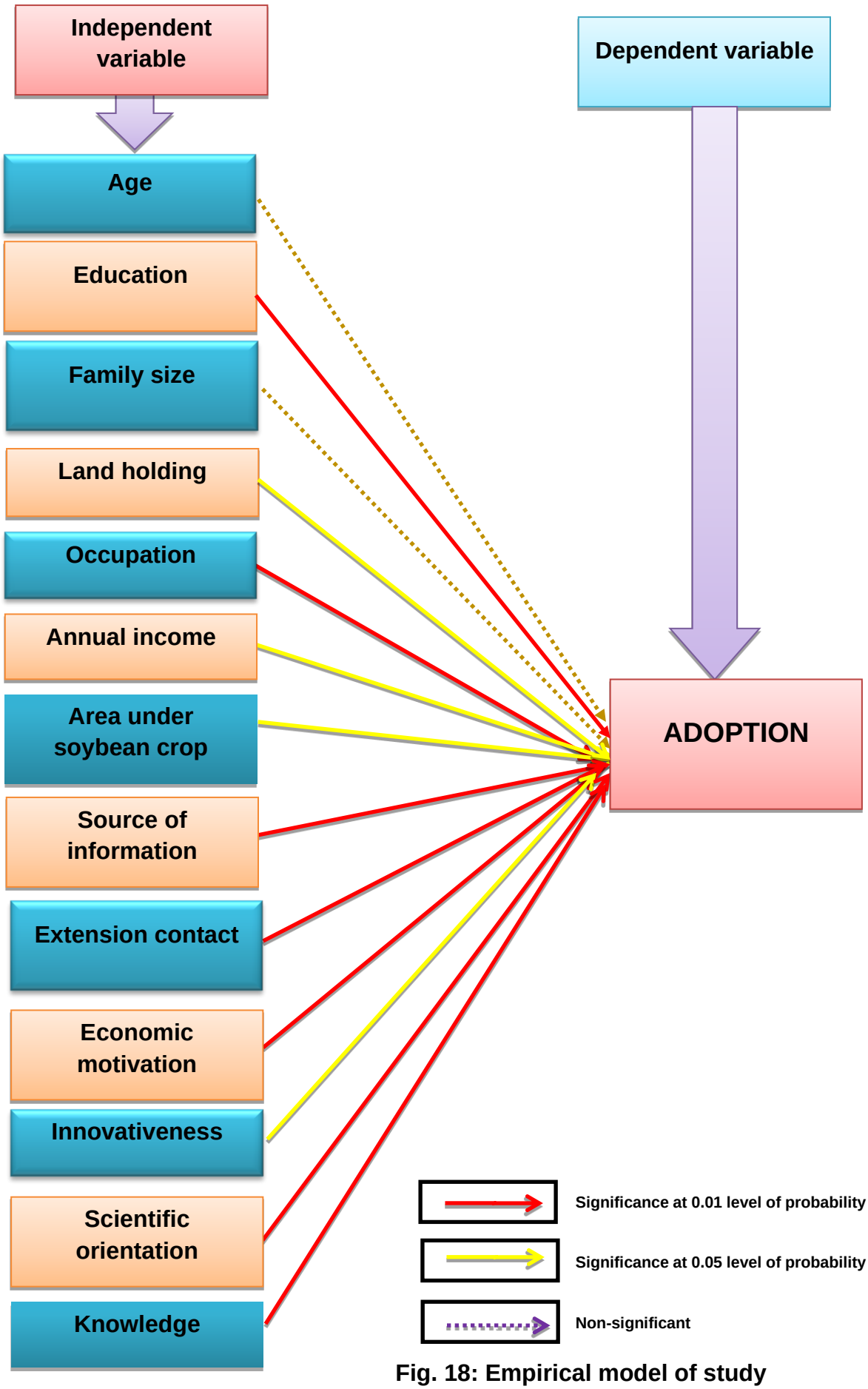

Fig. 18: Empirical model of study

CHAPTER V

SUMMARY AND CONCLUSIONS

Integrated Weed Management is the need of the situation as today farmers are facing pollution problem because use of strong chemicals in curing weed which degrade the soil quality. To overcome these effects scientist evolved some IWM technologies and recommended for soybean crop. But it was observed that soybean growers did not adopt these technologies to great extent. Hence this study named “Adoption of integrated weed management practices by soybean growers” was planned in Renapur and Shirur Anantpal Talukas of Latur District to investigate the adoption of integrated weed management practices by soybean growers. It was also thought to be worthwhile to ascertain the constraints faced by soybean growers in adoption of IWM practices. With this view in mind, the study was carried out with the following specific objectives.

1. To study the personal, socio-economic, communication, situational and psychological characteristics of the soybean growers
2. To study the Knowledge about recommended Integrated Weed Management practices
3. To study adoption of Integrated Weed Management practices by soybean growers
4. To find out the relationship of selected characteristics of soybean growers with adoption of Integrated Weed Management practices
5. To study the constraints faced by soybean growers in adoption of Integrated Weed Management practices

To study the constraints faced by soybean growers in adoption of integrated weed management practices for present study, the exploratory design of social research was used. The sample was drawn from Renapur and Shirur Anantpal Talukas of Latur District of Maharashtra state. 12 Villages from each were purposively selected as most of the farmers grows soybean crop in this District. 10 farmers were selected from each selected Village by using random sampling. Thus 120 farmers

constituted the sample for the study. Data was collected by personally interviewing the respondents with the help of pretested and structured schedule. The data collected were tabulated and the statistical tools namely mean, standard deviation, frequency, percentage and correlation coefficient were employed for interpretation of the findings. Null hypothesis set for the study was tested for its acceptance or rejection.

The characteristics of the farmers namely age, education, family size, land holding, Occupation, annual income, area under soybean crop, sources of information, extension contact, economic motivation, innovativeness, scientific orientation and knowledge were considered as independent variables and adoption as dependent variables.

5.1 Conclusion

The salient findings of the study are summarized in succeeding paragraphs.

5.1.1 Distributional analysis

5.1.1.1 Characteristics of respondents

1. Nearly half of the respondents (51.67%) belonged to middle age group (36 to 50 years).
2. Nearly one third of the respondents (30.00%) were educated up to high school level.
3. More than half (56.67 %) of the respondents belonged to medium size of family (5 to 7 members).
4. More than one third of the respondents (35.00%) belonged to semi-medium land holding category.
5. Majority of respondents (63.33%) had agriculture as the main occupation.
6. Majority of the respondents (70.83%) had annual income between of Rs.2, 25,415 to 6, 88,551 /-.
7. Majority of the respondents (62.50%) put up to 2.11 ha to 5.27 ha area under soybean crop.

8. Majority of the respondents (64.17%) had medium sources of information.
9. Over half of the respondents (59.17%) had medium category of extension contact.
10. Over half of the respondents (53.33%) had medium level of economic motivation.
11. Majority of the respondents (60.00%) had medium level of innovativeness.
12. Majority of the respondents (66.67 %) had medium scientific orientation.
13. Over half of the respondents (51.67%) had medium level of knowledge.

5.1.1.2 Adoption

High proportion (70.00%) of respondents belonged to medium category of adoption about integrated weed management practices for soybean crop.

Specific practice wise adoption

1. Majority of (81.67%) the respondents had adoption of proper sowing time.
2. Very few of (14.17%) the respondents had complete adoption of crop rotation.
3. Majority of (60.83%) the respondents had complete adoption of hoeing.
4. Majority of (70.83%) the respondents had complete adoption of hoeing at 20.DAS.
5. Above one fourth of (26.67%) the respondents had complete adoption of hoeing at 30 DAS.
6. Half of (50.00%) the respondents had complete adoption of irrigation management.
7. Over half of (58.33%) the respondents had complete adoption of farm hygiene.

8. Near about half of (48.33%) the respondents had complete adoption about use of uncontaminated seeds for sowing.

9. About one fourth of (25.83%) the respondents had complete adoption of balance use of fertilizer (RDF).

10. Near about one third of (30.83%) the respondents had complete adoption of intercropping of soybean plus tur.

11. Any of the respondents had not adopted intercropping of soybean plus sorghum.

12. Total (100.00%) the respondents had adopted ploughing practice.

13. Majority of (70.00%) the respondents had complete adoption of harrowing practice.

14. Majority of (83.33%) the respondents had complete adoption of hand weeding at 25 DAS.

15. More than one third of (40.00%) the respondents had complete adoption of 45 DAS.

16. Over one fourth of (25.83%) the respondents had complete adoption of inter cultivation through different farm implements.

17. Very few of (09.17%) the respondents had complete adoption of cleaning of machinery to prevent spread of weed.

18. Majority of (83.33%) the respondents had complete adoption of use of different herbicide.

19. Majority of (96.67 %) the respondents had complete adoption of use of recommended per ha. dose of herbicide.

20. Near about one third of (30.83%) the respondents had complete adoption of time of herbicide application.

21. Very few of (09.17%) the respondents had complete adoption of use of appropriate recommended doses.

22. Negligible of (02.50%) the respondents had complete adoption of pre sowing herbicide.

23. Half of (50.00%) the respondents had complete adoption of pre emergence herbicide.

24. Majority of (91.67%) the respondents had complete adoption of post emergence herbicide.

25. Half of (50.00%) the respondents had complete adoption of application of herbicide when sufficient moisture is present in soil.

26. Majority of (66.67%) the respondents had complete adoption of different types of spray pumps used for spraying herbicide.

27. Near about one fourth of (22.50%) the respondents had complete adoption of different types of nozzle used for herbicide application in soybean.

28. Over half of (55.83%) the respondents had complete adoption of reading the label before use.

29. Very few of (16.67%) the respondents had complete adoption of wearing goggles, rubber gloves before handling and use of chemicals.

30. Majority of (%) the respondents had complete adoption of avoid herbicide spraying during high speed wind and cloudy weather.

31. Majority of (69.17%) the respondents had complete adoption of use of clean water for herbicide application.

32. Majority of (72.50%) the respondents had complete adoption of herbicide kept in safe place.

33. Majority of (62.50%) the respondents had complete adoption of disposal of empty containers.

34. Very few of (18.33%) the respondents had complete adoption of use of separate sprayer for herbicide application.

35. Half of (50.00%) the respondents had complete adoption of intercultural operation not taken within 4-5 days after herbicide application.

5.1.2 Relational analysis

5.1.2.1 Correlation coefficients

Among selected variables education, occupation and source of information, extension contact, economic motivation, scientific orientation and knowledge was positively and significantly correlated with adoption at 0.01 per cent level of probability. However the variables land holding, annual income, area under soybean crop and innovativeness was positive and significant with adoption of the respondents at 0.05 per cent level of probability. So the null hypothesis (H_0) was rejected.

The variable age and family size was negative and non-significant with the adoption of the respondents. The null hypothesis (H_0) was therefore accepted.

5.1.3 Constraints faced by them in adoption of integrated weed management practices

Constraints encountered by the respondents in adoption of integrated weed management practices were recorded and the constraints which are to be important were present.

The constraints recorded reveal that cent-per cent (100%) each of the respondents were facing the constraints viz. higher cost of herbicides, load shedding and problem of wild animals respectively, it was followed by lack of technical guidance (85.00%), inadequate supply of irrigation water in annual cropping system (76.67%), inadequate supply of labour for hand weeding (84.17%), lack of knowledge about use appropriate dose of herbicide (55.83%), lack of proper information about chemical weed control (62.50%), problems regarding financial sources were faced by (56.67%), rains after spray hampers the effect of herbicide were faced by (65.83%) and also observed that lack of knowledge and adoption about precautions taking while spraying was (35.83%) are some of the major constraints faced by the respondents.

CHAPTER VI

IMPLICATIONS

Based on the findings of present research on integrated weed management practices in soybean crop the implication suggested have been presented into two parts. First part is concerned with the implication for action and second part deals with implication for future research. The findings of the study would be useful for extension personnel, policy makers and university scientist in promoting the adoption of integrated weed management practices by soybean growers. Based on the findings of present study following suggestions in the form of implication are offered.

6.1 Implication for action

1. Findings with regards to adoption revealed that majority of soybean growers were having medium level of adoption regarding IWM practices in soybean crop. The overall adoption of IWM practices use by the soybean farmers were in medium level category.
2. From findings with regards to adoption it is also found that majority of respondents have not adopted the IWM practices like crop rotation, balance use of RDF, intercrops, cleaning of machinery, use of appropriate recommended doses, use of pre sowing herbicide and also precautions like reading of label, wearing of goggles and gloves and also low adoption of disposal of empty chemical container.
3. On the basis of these findings it is implies that extension functionaries should organize result demonstration so as to witness the result by the farmers themselves in their own setting and it helps in arousing the interest of respondents and decide on their part which is prerequisite for use of IWM practices in soybean crop. In this context it is also suggested that information regarding IWM practices use in soybean crop should be disseminated to the soybean growers by extension functionaries of State Department of Agriculture, NGO’s and Agriculture Universities, through

demonstration, trainings field visits, distribute the leaflets, printed materials and the other media of transfer of technology for imparting knowledge & increased adoption about integrated weed management practices.

4. Constraints analysis revealed that the major constraints for non-adoption of integrated weed management was cost of herbicides is high, inadequate supply of labour for hand weeding, lack of knowledge about use of appropriate dose of herbicides, the lack of proper information about chemical weed control. It is therefore implicated that training and awareness programme about biological weed control as a substitute to costly herbicides should be conducted at Village level by different extension functionaries. In addition to this government interventions should be there in making availability of herbicide in time and at reasonable cost. It is also suggested that introduction of modern weed management farm implement at Village level through conduction of awareness program should be conducted by agricultural universities.

6.2 Implications for future research

1. The present study was confined only to limited number of respondents in Renapur and Shirur Anantpal Talukas of Latur District in Marathwada region of Maharashtra state with restricted sample size. Therefore, generalization based on this study is applicable to those areas only.
2. It is observed that in case of soybean growers in Renapur and Shirur Anantpal Talukas adoption of weed management practices of soybean crop were observed in medium level. It is therefore necessary to taken up research as knowledge and adoption of weed management practices followed by soybean growers.
3. Present study has made important indications in this regard which may be useful in studying adoption of weed management practices followed by soybean growers in other areas.

4. Limited efforts have been made in present study was undertaken in only 12 Villages. For driving generalization of wider applicability study may be carried on a larger area with more samples.
5. The present study was confined only for soybean crop a detailed study including all crops grown in Rabi and summer season for raising the production and reducing losses caused by weed infestation. Therefore, comprehensive research studies are needed to plan in future.

CHAPTER VII

LITERATURE CITED

Ambhore, S. S., 2006. Reason for variation in area under soybean crop in Buldhana District. M.Sc. (Agri.) Thesis (unpub), Dr. PDKV, Akola.

Anuradha Ranjan Kumari, Raksha Pal Singh, S. K. Mandal and R. K. Manda, 2020. Extent of knowledge and adoption of pigeon pea technology by the farmer*. Indian Journal of Extension Education Vol. 56, No. 1, 2020 (159-163).*

Ashish Kumar, 2012. Adoption behavior of farmers about recommended technologies of soybean. M.Sc. Thesis (Unpub.), Dr. PDKV, Akola.

Atar, R.S. 2012. Study on knowledge and adoption of recommended grape cultivation practices by the grape growers. M.Sc. (Agri.) Thesis (unpb.), MKV, Parbhani.

Barkade, A. T. 2015. Knowledge and adoption of integrated weed management practices followed by cotton growers in Washim District. M.Sc. (Agri.) Thesis (unpub.), Dr. PDKV, Akola.

Bhaltilak Kajal, 2017. Knowledge and adoption of insecticide as per the label claim by cotton growers in Akola District. M.Sc. (Agri.) Thesis (Unpub.), Dr. PDKV, Akola.

Bhandare, C. L. 2011. Adoption of recommended package of practices of sweet orange in Aurangabad District, M.Sc. (Agri.) Thesis, (unpb.) MKV,Parbhani.

Bhowmik, P. C. 1998. Weed biology: Importance to weed management. Department of Plant and Soil Sciences, University of Massachusetts, MA 01003.

Bhople, P. P., Mankar, D. M., Kale, N. M., Wankhade, P. P., 2015. Work performance and drudgery perceived by the farm labours in agricultural work and MANREGA. Research Review Committee Project, Dr. PDKV, Akola. March, 2015.

Deogikar, Vaishu 2014. Knowledge and adoption of herbicide by the soybean growers. M.Sc. (Agri.) Thesis (unpb.), Dr. PDKV, Akola.

Deshmukh, P. R., R. P. Kadam and V. N. Shinde, 2007. Knowledge and adoption of agriculture technologies in marathwada. *Indian Research Journal of Extn. Educ. 7(1):41-42.*

Deshmukh, P. R., Bhosale, P. B. and Wattamwar, V. T., 2011. Technological gap in soybean production practices. *Indian Journal of Social Research. 52(3):257-264.*

English and English, 1961. Definitions of knowledge oxforddictionaries.com.

Ghintala, A. and Singh, K. 2013. Knowledge and adoption of sprinkler irrigation system by the farmers of Banankashta District of North Gujrat. *Indian Journal of Extension Education and Rural Development, 21-26-29.*

Gudadhe, N. M. 2015. Impact of integrated pest management practices on soybean under NRTT project. M.Sc. (Agri.) Thesis (Unpub.), Dr. PDKV, Akola.

Hingne, B.T. 2016. Adoption gap in recommend package of practices of soybean. M.Sc. (Agri.) Thesis (unpub.), Dr. PDKV, Akola, Maharashtra.

Jadhav, Archana 2017. Impact of crop pest surveillance and advisory project on beneficiary. M.Sc. (Agri.) Thesis (unpb.) Dr. PDKV, Akola, Maharashtra.

Jatesh Kathpalia, Rashmi Tyagi, Mukesh Jain, Ajit Sangwan and Vinod Kumar, 2020. Adoption and constraints in agricultural technology with special reference to rotavator among farmers in Haryana. *Indian Journal of Extension Education Vol. 56, No. 1, 2020 (233-237).*

Kale, N. M., D. M. Mankar, J. P. Deshmukh and P. P. Wankhade, 2014. Adoption of herbicide application practices by soybean and cotton farmers in Vidarbha. Research Review Committee Project, Dr. PDKV, Akola. 18 March, 2014.

Kale, N. M., D. M. Mankar, J. P. Deshmukh and P. P. Wankhade, P. P Bhople 2015. Adoption of herbicide application practices by wheat farmers in Vidharbha. Research Review Committee Project, Dr. PDKV, Akola. March, 2015.

Katole, R. T., U. R. Chinchmalatpure and V. A. Khadse 2015. Extent of adoption of compositing methods by the farmers. Research Review Committee Project, Dr. PDKV, Akola. March, 2015.

Kulshetra A., S. S, Parmar. 1992. Smart weed management. Indian Society of Weed Science, 1992.

Lad, A. S. 2013. Knowledge and adoption of recommend package of practices of green gram. M.sc (Agri.) Thesis (unpb.), VNMKV, Parbhani.

Lokhande, R. K. 2007. A study on adoption of integrated pest management practices by soybean growers in Indore District of M.P. M.Sc. (Agri.) Thesis (unpub.), JNKVV, Jabalpur.

Macchar R. G., S. K. Patel, H. L. Kacha, U. M. Patel, G. D. Patel ,R. Radha Rani, 2015. Technological gap in adoption of improved soybean production technology by soybean growers in Dahod District Gujarat. *American Journal of Agriculture and Forestry .3(6): 276-279.*

Mandlik, S. P., 2012. Knowledge and adoption of integrated pest management technoloogy in pigeon pea. M.Sc. (Agri.), Thesis (unpb.), MKV, Parbhani.

Mane, S. S., 2012. Knowledge and adoption of recommended production technology on green gram. M.Sc. (Agri.) Thesis (unpb.), MKV, Parbhani

Manish Kumar, Neerja Patel, Moni Singh and Ankita, 2019. Adoption of integrated pest management (IPM) practices: A case study in Malwa region of Madhya Pradesh. *Indian Journal of Extension Education Vol. 55, No. 2, (160-163).*

Mankar, D. M., N. M., Kale, R. S., Waghmare, P.P., Wankhade, P. P. Bhople, R. N. Katkar 2015. Soil testing status of the farmers in the distress prone Districts of Vidarbha. Research Review Committee Project, Dr. PDKV, Akola.

Maraddi, G. N., 2006. An analysis of sustainable cultivation practices followed by sugarcane growers in Karnataka. Ph.D. Thesis (Unpub.), University of Agricultural Sciences, Dharwad.

Mohite, V. S. 2013. Adoption of biofertilizer by soybean growers in western vidarbha. M.Sc. (Agri.) thesis (Unpub.), Dr. PDKV, Akola.

Naina Virang 2016 Study on knowledge and adoption behavior of soybean growers under ATMA program in Devas District of Madhya Pradesh." M.Sc. (Agri.) Thesis (unpub.) RVSKVV, Gwalior (Madhya Pradesh).

Nichal, R. S. 2010. Knowledge and adoption of recommended package of practices by jasmine growers in Nanded District. M.Sc. (Agri.) Thesis (unpb.), MAU, Parbhani.

Noor ul Islam wani, Hakeem, A. H., Dar, M. A., Khalid Rasool, Showkat Maqbool and Rihanna, H. K., 2020. Knowledge level about important production practices of high density apple growers of Kashmir Valley. *Indian Journal of Extension Education Vol. 56, No. 3, 2020 (29-34).*

Patel, Rambha, Mazhar and Syed H. 2019. To determination the level of knowledge of respondents about integrated disease management practices of rice crop in Lailunga block Raigrah District (Chattisgrah). *Indian Research Journal of Extension Education 19(1): 24 - 27.*

Rajput, H. D. and Chinchmalatpure, U. R. 2016. Knowledge and adoption of BT cotton cultivation practices. *Indian Journal of Extension Education. Volume 52 Issue 1 and 2 pages 121-123.*

Rajshekhar, B., 2015. A study of adoption of integrated weed management practice in major crops in Mehboobnagar District of Telangana

state. M.Sc. (Agri.) Thesis (unpb.) Prof. JayshankarTelangana State Agriculture University.

Raviya, P. B., G. R. Gohil, K. P. Aphasiac and V. J. Savaliy, 2020. Extent of adoption of recommended cotton production practices by the farmers of Junagadh District of Gujarat State. *Indian Journal of Extension Education Vol. 56, No. 1, 2020 (195-196).*

Rogers, E. M. 1995 Diffusion of innovation. The Free Press, New York, 167

Ramesh Chand, Anuj Kumar, R Sendil, Satyavir Singh and Randhir Singh, 2019. Weed Management Strategy of Farmers in Wheat in North India. *Indian Journal of Extension Education Vol. 55, No. 2, 2019 (30-35).*

Sahoo, K. M. and Saraswat, V. N. 1998. Magnitude of losses in the yields of major crops due to weed competition in India Pesticide Information, April-June, pp: 2-9.

Sangeetha V., S. V. Prasad and Venkatesh, 2009. Knowledge of cotton growers in the recommended package of practices of cotton cultivation. *Indian Journal of Extension Education Vol.45, No. 3 & 4, 2009 (7-10).*

Savant, S. M. 2011. Knowledge and adoption of weed management practices by cotton growers. M.Sc. (Agri.) Thesis (Unpub.), Dr. PDKV, Akola.

Sawale, S. V. 2011. Knowledge and adoption of post-harvest technology by pomegranate growers. M.Sc. (Agri.) Thesis (unpb.), MKV, Parbhani.

Sikarwar, Rahul Singh 2019. A study of Adoption level of improved soybean production technology in Sehore block of District Sehore Madhya Pradesh. M.Sc. (Agri.) Thesis (unpub.) RVSKVV, Gwalior (Madhya Pradesh).

Singh R., 1972. A study of socio-psychological values and some biographical characteristics in relation to adoption of farm mechanization by the farmers of Ludhiana (Punjab). Ph.D. Thesis (unpb.) Punjab Agricultural University, Ludhiana, India.

Singh Shivpal., 2015. A study on adoption of integrated pest management practices by soybean growers in Pandhana block of Khandwa District (M.P). M.Sc. (Agri.) Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur Madhya Pradesh.

Supe S. V. 1969. Factors related to different degree of rationality in decision making among farmers in Buldhana District. Ph.D. thesis, (unpb.) Department of Agricultural Extension, Indian Agricultural Extension, Indian Agricultural Research Institute, New Delhi.

Tayade A. T., 2016. Awareness and adoption of Broad Bed Furrow Technology in soybean crop. M.Sc. (Agri.) Thesis (unpb.) Dr. PDKV, Akola, Maharashtra.

Tekale, V. S., 2015. Entrepreneurial behavior of vegetable growers. Research Review Committee Project, Dr. PDKV, Akola. March, 2015.

Thorat, S. A., 2013. Knowledge and adoption of improved package of practices of sunflower growers. M.Sc. (Agri.) Thesis (unpb.), VNMKV, Parbhani.

Tilekar, Y. M., 2010. Knowledge and adoption of integrated pest management practices by soybean growers. M.Sc. (Agri.), Thesis (Unpub.), Dr. PDKV, Akola.

Waywal, Anand 2019. Knowledge and adoption of integrated pest management practices by cotton growers. M.Sc. (Agri.) Thesis (unpub.) Dr. PDKV, Akola, Maharashtra.

Yesankar J. M. 2010. Participation of rural women in farm management M.Sc. (Agri.), Thesis (Unpub.) College of Agriculture, Nagpur. Dr. PDKV, Akola.

VITA

1. Name of student : **Mahalinge Vishakha Rajkumar**
2. Date of Birth : 03th June 1997
3. Name of the College : Department of Extension Education, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
4. Residential Address : At /Post. latur, Tal.Latur, Dist.Latur.
5. Academic Qualification :

Sr. No.	Name of Degrees awarded	Year in which obtained	Division/ Class	Name of awarding University	Subjects
1.	B.Sc. (Agri.)	2019	First Class	VNMKV, Parbhani.	Agriculture and allied subjects

6. Research papers published (if any) : NILL
7. Field of Interest (in which you desire to work) : Extension Education

Place: Akola

Date: / /2021 **Signature of Student**

APPENDIX- I

INTERVIEW SCHEDULE

Title of Thesis	**:**	**ADOPTION OF INTEGRATED WEED MANAGEMENT PRACTICES BY SOYBEAN GROWERS.**
Name of Researcher	**:**	**MAHALINGE VISHAKHA RAJKUMAR** M.Sc. (Agri.) IInd Year Department of Extension Education Dr. PDKV, Akola.

PART- I

A. General information

1.	Name of the farmer	
2.	Village	
3.	Taluka	
4.	District	
5.	Mobile No.	

B. Personal, socio-economic, communicational, situational and psychological characteristics

2. Education: Standard passed…….

3. Family size

Sr. No.	Category	Family members
1	Small	Up to 4
2	Medium	5 to 7
4	Large	Above 7

4. Land holding

Sr. No.	Category	Land holding (ha)
1	Marginal	Up to 1.00
2	Small	1.01 – 2.00
3	Semi medium	2.01 - 4.00
4	Medium	4.01 – 10.00
5	Large	Above 10.00

5. Occupation

Sr. No	Occupation	Score
1	Agriculture + Labor	
2	Only Agriculture	
3	Agriculture + Allied occupation (goat farming/poultry/fisheries)	
4	Agri. + business - (professional/non-professional)	
5	Agri. +Service/pension	

7. Annual Income

Sr. No	Name of crop	Area (ha)	Production
1	**Kharif**		
1.1			
1.2			
1.3			
2	**Rabi**		
2.1			
2.2			
2.4			
3	**Summer**		
3.1			
3.2			

a) Income from Agriculture : Rs.....
b) From other occupation : Rs… ……
c) **Total (**a+b=c) : Rs……..

8. Area under soybean crop.

Name of variety	Area in ha.

9. Source of information.

Sr. No.	Source of information	Always (2)	Sometimes (1)	Never (0)
(A)	**Personal localite sources**			
1	Neighbors			
2	Friends			
3	Relatives			
4	Progressive farmers			
5	Gram Panchayat Members			
6	Local leader			
(B)	**Personal cosmopolite sources**			
1	Gram Sevak			
2	Krishi Sevak			
3	Agricultural Supervisor			
4	Agricultural Officer			
5	Participation in trainings			
6	Participation in group meetings/field days			
7	Visit to soybean demonstration plots			
8	Visit to Agricultural University			
9	Visit to KVK			
10	Agro Input Dealer			
11	Study Tour			
(C)	**Mass media**			
1	Radio			
2	Television			
3	Newspaper			
4	Farm Magazine			
5	Agri. Exhibition			
6.	Agro Technology Week			

10. Extension contact.

Sr. No.	Extension contact	Always (2)	Sometimes (1)	Never (0)
i)	Sarpanch			
ii)	Gramsevak			
iii)	Extension Officer/Agricultural Officer			
iv)	Block Development Officer			
v)	University Scientist			
vi)	KVK Scientist			
vii)	Cell phonic contact with Scientist's			

11. Economic motivation.

Sr. No	Statement	SA (5)	AG (4)	UD (3)	DA (2)	SD (1)
1.	A farmer should work towards large yield an economic profit.					
2.	The most successful farmer is one who makes more profit.					
3.	A farmer should try any new farming idea, which may earn him more money.					
4.	It is important for farmer to have large harvest.					
5.	It is difficult for the farmer's children to make good start unless he provides them with economic assistance.					
6.	A farmer must earn his living but the most important thing in life is one which cannot be defined in economic terms.					

SA -: Strongly agree **AG** -: Agree **UD**-: Undecided **DA** -: Disagree **SDA** -: Strongly disagree

12. Innovativeness.

Sr.no.	Statements	Agree	Undecided	Decided
1	I feel restless till I try out a new IWM Practices I have heard about it			
2	Talk of many IWM practices these days but who know if they are better than old one			
3	After all over forefather were wise in their IWM practices and old not see any reason for changing these old methods.			
4	Often IWM practices are not successful however if they are promising I would surely like to adopt them.			
5	From time to time I have heard of several IWM Practices and I have tried the most of these in last few years.			
6	Somehow I have believed that traditional technologies are the best			

13. Scientific orientation.

Sr. No.	Statement	SA	A	UD	DA	SDA
1.	New methods of farming gives better Results than old methods.					
2.	The way farmers forefather farmed Is still the best way to farm today?					
3.	Even a farmer with lot of experience Should use new methods of farming.					
4.	Though it makes time for a farmer to Learn new methods in farming it is worth efforts.					
5.	A good farmer experience with new ideas In farming.					
6.	Traditional methods of farming have to be Changed in order to raise the level of Living of farmers.					

SA -: Strongly agree **AG** -: Agree **UD**-: Undecided **DA** -: Disagree **SDA** -: Strongly Disagree.

14. Knowledge about Integrated Weed Management Practices

A	**Do you have knowledge about Preventive Weed Management practices**	**Yes**	**No**
1	sowing time		
2	Crop rotation		
3	Use of Hoeing		
4	**Time of hoeing**		
4.1	First at 20 DAS		
4.2	Second at 30 DAS		
5	Irrigation management		
6	Farm hygiene		
7	Use of uncontaminated seeds for sowing.		
8	Balance use of fertilizer (RDF)		
9	**Intercrops**		
9.1	Soybean + Tur		
9.2	Soybean + Sorghum		
B	**Do you have knowledge about mechanical weed control?**		
1	Ploughing		
2	Harrowing		
3	Use of hand weeding		
3.1	One at 25 DAS		
3.2	One at 45 DAS		
4	Inter-cultivation through different farm implements		
5	Cleaning of machinery to prevent spread of weeds		
C	**Do you have knowledge about chemical weed control?**		
1	Knowledge about name of recommended herbicide used for soybean		
2	Knowledge about recommended per ha. dose of herbicide		
3	Time of herbicide application (pre emergence/post emergence)		
4	Use appropriate recommended doses		

5	Use of pre sowing herbicide (Fluchloralin 45 EC.)		
6	Use of pre emergence herbicide (Eg. Pendamethalin.)		
7	Use of post emergence herbicide (Eg.Imazethapyr)		
8	Knowledge about sufficient moisture in soil during herbicide application		
9	Knowledge about types of spray pump used for spraying herbicide (knapsack spray pump)		
10	Knowledge about types of nozzle used for herbicide application in soybean (Flat fan /flood jet type nozzle)		
11	**Precautions while using herbicide:-**		
11.1	Read the label before use		
11.2	Wear goggles, rubber gloves before handling and use of chemicals		
11.3	Knowledge about herbicide spraying during high speed wind and cloudy weather		
11.4	Use of clean water for herbicide application.		
11.5	Herbicide kept in a safe place		
11.6	Dispose of empty containers		
12	Knowledge about Separate sprayer to be used for herbicide application		
13	Knowledge about intercultural operation within 4-5 days after herbicide application		

PART II

1. Adoption of Integrated Weed Management Practices

A	Do you adopt preventive Weed Management practices	complete	partial	No adoption
1	sowing time			
2	Crop rotation			
3	Use of Hoeing			
4	**Time of hoeing**			
4.1	First at 20 DAS			
4.2	Second at 30DAS			
5	Irrigation management			
6	Farm hygiene			
7	Use of uncontaminated seeds for sowing.			
8	Balance use of fertilizer (RDF)			
9	**Intercrops**			
9.1	Soybean + Tur			
9.2	Soybean + Sorghum			
B	**Do you adopt mechanical weed control?**			
1	Ploughing			
2	Harrowing			
3	Use of hand weeding			
3.1	One at 25 DAS			
3.2	One at 45 DAS			
4	Inter-cultivation through different farm implements			
5	Cleaning of machinery to prevent spread of weeds			
C	**Do you adopt chemical weed control?**			
1	Use of different herbicide			
2	Use of recommended per ha. dose of herbicide			

3	Time of herbicide application (pre emergence/post emergence)			
4	Use appropriate recommended doses			
5	Use of pre sowing herbicide (Eg. Fluchloralin 45 EC.)			
6	Use of pre emergence herbicide (Eg. Pendamethalin)			
7	Use of post emergence herbicide (Eg. Imazethapyr)			
8	Application of herbicide when sufficient moisture in present in soil			
9	Types of spray pump used for spraying herbicide (knapsack spray pump)			
10	Types of nozzle used for herbicide application in soybean (Flat fan /flood jet type nozzle)			
11	**Precautions while using herbicide:-**			
11.1	Read the label before use			
11.2	Wear goggles, rubber gloves before handling and use of chemicals			
11.3	Avoid herbicide spraying during high speed wind and cloudy weather			
11.4	Use of clean water for herbicide application.			
11.5	Herbicide kept in a safe place			
11.6	Dispose of empty containers			
12	Use of separate sprayer for herbicide application			
13	Intercultural operation not taken within 4-5 days after herbicide application			

PART - III

III. Constraints

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IV. Suggestions (If any)

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