**Farmer's Knowledge on pesticides usage in paddy and cabbage crops**


## ABSTRACT

More than a thousand pesticides of both chemical and biological nature are used around the world to minimize crop losses. The study was conducted to investigate the knowledge of the farmers on pesticide use in selected crops during 2019-22.Two crops namely paddy and cabbage were selected and tow districts that have higher area namely Koppal and Belagavi were selected. In each district, two taluks and eighty farmers were selected for each crop by simple random procedure to form a total sample of 160 farmers. Overall knowledge index of pesticides by farmers was higher in case of paddy (73.57%) and cabbage (64.76%) farmers. Among the various dimensions, knowledge index was highest with respect to concentration and application practice (96.72% & 82.97%), types of sprayers and maintenance (91.25% & 87.50%), IPM practices (73.75% & 70.00) among paddy, and cabbage. Further, knowledge with respect to pest identification (69.06% & 57.66%), toxicity of pesticide and labels signs (68.59% & 61.09%) and disposal of pesticides and personal hygiene (67.86% & 61.09%) was around sixty percent among cabbage and paddy growers respectively. Further, low index was observed with respect to pesticide selection (26.88% & 38.54%) in case of paddy and cabbage growers respectively. The findings revealed that overall knowledge category of pesticide use majority (72.50%) of the growers belongs to medium knowledge of pesticide category in case of paddy, low knowledge category in cabbage crop (38.75%).


**Comment [KM1]:** Add conclusions and policy suggestions to the abstract


**KEY WORDS:** knowledge, pesticide use, paddy farmers, cabbage farmers


## INTRODUCTION

Plant pests are known for causing significant losses ~~on~~ incrop production ~~throughout~~ acrossthe world.~~.~~Various management strategies~~,~~ like host plant resistance, physical barriers, botanical pesticides, biological control, biotechnological approaches, and synthetic pesticides have been developed to tackle the pests. Most widely used technique under field conditions is the chemical~~ly~~ based management system. Synthetic pesticides are mostly used against pests in the field due to their capability and high reliability in protecting crops and thus ensuring high crop yields. Recent reports suggest~~sed~~ that ~~still~~ approximately 5 billion kg of pesticides are used in the agricultural fields throughout the world even after introduction of novel molecules~~,~~ like diamides, oxadiazines, neonicotinoids, which have higher efficacy against insects with lower dosages (FAO, 2020). Among different continents, South America ranks first in pesticide usage estimated at~~.~~42 kg/ha, followed by Asia (3.67 kg/ha), North America (2.51 kg/ha), Oceania (2.09 kg/ha), Europe and Africa (0.29 kg/ha) (FAO, 2020).

Pesticides can provide a variety of advantages, the most evident of which can be calculated. Pesticide abuse and overuse cause both direct and indirect harm. Environmental consequences the indirect repercussions include harmful consequences for humans. Health, environmental degradation, biodiversity loss, and irreversible alterations to ecosystems. One of the biggest obstacles today agricultural production facing is the catastrophic consequences of pest infestation. Crop losses in the country owing to different pests vary from 10% to 30% per year, depending on the degree of pest assault. Pest management became a need in order to meet the challenge, and chemical treatment became the most popular approach for increasing crop output in a sustainable manner. Pesticides are used on around 40% of the country's total agricultural land. Irrigation covers around 65-70 percent of the pesticide-treated planted area (DES, 2015). In addition, a recent report by the Food Safety Standards Authority of India (FSSAI) suggested that out of 1177 rice samples analyzed, 256 samples (21.7%) were found with exceeding the FSSAI maximum residue level (MRL) which is a serious concern against clean production. Furthermore, 65 rice samples (5.5%) were detected with non-approved pesticides (FSSAI, 2019) questioning the awareness level of farmers. Pesticide residues are found in more than half (51%) of India's food commodities, with 20% percent having pesticide residues over the allowed level.The United States and the European Union have issued the most alerts for violation with their prescribed food safety standards to India. The commodities most affected by non compliance include spices, fresh and processed fruits and vegetables (Idris *et al.*, 2015). The repeated use of broad-spectrum pesticides for insect control not only raised production costs, but also polluted the environment through hazardous residues (Guo *et al.*,1999).The over use of pesticides may be due to lack of knowledge. The present study is taken up to assess the knowledge of farmers in pesticide use in paddy and cabbage crops.

**Comment [KM2]:** Vauge

**Comment [KM3]:** Give reference

**Comment [KM4]:** Rather than providing lot of information about consequences and ill effects of pesticides, data/information regards to usage pattern of pesticide across the globe can be added, which is more relevant to the study.

**Comment [KM5]:** Why only farmers of paddy and cabbage is considered?

**Comment [KM6]:** Highest area across the state or highest area under crops within the selected districts? If it is second case why only the paddy and cabbage is considered?

## MATERIAL AND METHODS

The study was conducted in Koppal and Belagavi districts ~~located~~ in north part Karnataka state. ~~t~~These districts were purposively selected considering higher area in the selected crops namely paddy, and cabbage. Eighty farmers growing each paddy and cabbage were selected by simple random procedure framing a sample 160 farmers. The data was collected using structured schedule through personal interview method~~s~~. Knowledge level of farmers on pesticide use was assessed through knowledge statements developed for the study including various dimensions such as pest identification ~~pest~~, pesticide selection, knowledge on concentration levels and application methods, types of sprayers used and maintenance, toxicity of pesticides, and labels

signs, storage, disposal of pesticides and hygiene, IPM practices. Knowledge statements were administered to the farmers in the form of multiple choice questions that had four alternatives of which one was correct and others were incorrect. A score of one was assigned to correct answer and zero for the incorrect. The summation of scores of the correct answer for a particular respondent indicates his knowledge towards pesticide use. Based on obtained score, the respondents were classified into three categories namely, "Low", "Medium" and "High" using mean and standard deviation as a measure of check.

Knowledge index was computed by using the following formula,

$$\text{Knowledge index (\%)} = \frac{\text{Score obtained by the respondents}}{\text{Maximum obtainable score}} \times 100$$

**RESULTS AND DISCUSSION**

**PROFILE OF THE FARMERS GROWING PADDY AND CABBAGE**

**EDUCATION**

The findings from table 1 revealed that education of the paddy and cabbage growers observed that in case of paddy 37.50 percent of the farmers had completed middle school and 25.00 percent of them had studied up to the primary school level. Similarly, in case of cabbage growers 33.75 percent had completed primary school, twelve percent had completed middle school and 23.75 percent had completed high school level~~,~~—. commercial crops and its cultivation is often undertaken by educated and risk-taking farmers. It is simple for them to learn and use innovations in production technology as well as marketing. Literacy rates among farmers exceeded 80.00 percent, because of the significance of basic education and government programmes such as the Sarva Shiksha Abhiyan and the Mid-day Meal Scheme. The findings are consistent with those of Yeasmin *et al.* (2018) which showed that a large portion of vegetables growing farmers 70.00%) were educated but a significant portion of the respondents (23.00%) were illiterate.

**LAND HOLDING**

**Comment [KM7]:** Details regarding number of question presented to the farmers and classification range for low, medium and high can also be added in the section.

**Comment [KM8]:** Majority of the farmers who do cabbage cultivation has only primary level of education. How does the author connects education with risk taking ability in this case?

**Comment [KM9]:** Both the schemes in Karnataka has been introduced in the early 2000s. The farmers whom benefitted through the programmes will be in early 20s. Justification the same with age detailsof sample farmers can be added.

It was evident from the data that nearly seventy per cent of the farmers were belonged to small and semi medium landholding categories in ~~all~~ both the crops studied. As reported by many studies, fragmentation is common when the land is passed down from ancestors to children. However the land holding of paddy and cabbage farmers were higher 4.046 ha. Such commercial crops are normally taken by farmers who have more land. The findings are consistent with those of Padmaja (2018) who revealed that 36.67 per cent of the farmers belonged to medium landholding category followed by nearly equal number of farmers belonged to semi-medium (29.33 %) and small (28.00 %) landholding categories.

**OVERALL DISTRIBUTION OF THE FARMERS BASED ON SOCIO-ECONOMIC CHARACTERISTICS**

**Comment [KM10]:** Kindly recheck whether all/any of the below mentioned characteristics falls under socio-economic characteristics

**CROPPING INTENSITY**

Results in table 2 reported that overall distribution of the farmers based on socio-economic characteristics among the paddy and cabbage growers, over 80 percent the farmers were found in medium and high cropping intensity category. Paddy farmers normally take up two crops due to water summarized condition. As a results over 80 percent of the paddy & cabbage farmers found in medium cropping intensity category of 200 percent. These findings are on par with the findings of Ghintala (2013). He observed that more than two third (70.83%) of the farmers had medium level of cropping intensity followed by 17.50 percent and 11.67 per cent of the farmers had a high and low level of cropping intensity respectively.

**Comment [KM11]:** What is it mean?

**Comment [KM12]:** 200% ?

**RESEARCH EXTENSION LINKAGE**

The findings of table 2 highlighted the low extension contact of more than 40 percent of the farmers growing paddy and cabbage. It reflects that, less number of farmers visit agricultural or horticulture departments frequently. They must be seeking advice from informal sources such as friends and input dealers. However, these farmers should contact agriculture department as well as university scientists to get right advice. It is necessary to promote extension linkage both by physical and digital platform. Padmaja (2018) stated that 38.00 per cent of the farmers had low extension contact, followed by 31.33 per cent of them had high and 30.67 per cent of them had medium extension contact.

**Comment [KM13]:** Hypothetical.

**Comment [KM14]:** Conclusion or policy suggestion

**RESOURCE BASE**

**Comment [KM15]:** What Is it mean resource base?

The results revealed that over fifty percent (76.25% & 53.75%) of farmers growing paddy & cabbage possessed medium resource base. Majority of the paddy farmer's had ~~semi medium~~semi-medium landholding. Medium and big category farmers had possessed farm machinery and implements contributing to the above results and also availability of subsidy for the purchase of farm equipments. Manjunath (2010) studied on knowledge and adoption of plant protection measures by paddy growers of Raichur district and concluded that high majority (96.00 %) of the respondents possessed television. Vehicles and sprayers and dusters were possessed by 90.85 and 89.71 per cent of respondents, respectively. Agricultural implements and radio were possessed by 64.00 and 48.00 per cent of the respondents, respectively.

**ENVIRONMENTAL ORIENTATION**

Comment [KM16]: What is it mean? Quantification of environmental related issues is highly scientifical. How does it has been classified? Kindly add the supporting review.

Majority of the paddy and cabbage farmers were in medium environmental orientation category. Farmer were well aware about the fact that indiscriminate use of pesticides cause environmental hazards, However, they use pesticides more than required due to lack of knowledge .Farmers can see ill effects on the soil, water and pollinators as well as fish in their own field. Proper education and demonstrations are essential to bring change in pesticide usage.

**SOURCES CONSULTANCY PATTERN FOR PESTICIDE USE**

Majority of growers (78.75% & 58.75%) were identified in the medium sources consultancy pattern category in the case of paddy and cabbage crops respectively. The reason might be the crops studied are commercial crops, and all farmers must follow plant protection measures. It was observed during field visits they had also consulted private company representatives as well as progressive farmers for information. Devi *et al* (2017) reported that primary sources of information and guidance on pesticide use patterns, their degree of knowledge and dispensing pattern have an indirect impact on end-users and farmers' pesticide usage patterns. It is therefore critical to expand the knowledge of these non-professional service providers in order to give farmers with the most up-to-date and relevant information

**KNOWLEDGE OF THE FARMERS ON PESTICIDE USE IN FOR SELECTED CROP**

The results revealed that overall knowledge index of pesticides by farmers was higher in case of paddy (73.57%) and cabbage (64.76%) farmers. Among the various dimensions, knowledge index was highest with respect to knowledge on concentration and application practice (96.72%

&82.97%), types of sprayers and maintenance (91.25% & 87.50%) IPM practices (73.75% & 70.00%) among paddy and cabbage growers respectively. Further, knowledge with respect to pest identification (69.06% & 57.66%),toxicity of pesticide and labels signs (68.59% & 61.09%) and disposal of pesticides and personal hygiene (67.86% & 61.09%) ~~was around sixty percent~~ among cabbage and paddy growers respectively. Further, low index was observed with respect to pesticide selection (26.88% & 38.54%) in case of paddy and cabbage growers respectively (Table 3 and Fig1).Total quantity of pesticide used was higher in cabbage ~~and~~ than inpaddy.

Farmers need to get familiarized with pesticides application. Farmers lack knowledge of identification of pest and diseases, many a times the plant exhibits more than one symptom due to infestation of insects as well as pathogens. A farmer depends upon the input dealers or fellow farmers and tend to follow their advice. Hence, low index with respect to selection and identification was observed. It is surprising that farmers had good knowledge of concentration as well as types of sprayer. Study also revealed that farmers lack knowledge of toxicity and colour labels toxicity. It is important that farmers should have knowledge of pest and diseases as well as scientific use of pesticides. These signs of toxicity labels printed on the bottles or containers are not seen by the farmers. There is need to display these toxicity signs on different public places to educate the farmers. ~~Including input~~Including input shops. The paddy and cabbage farmers required on integrated pest management. Jallow *et al* (2017) reported that the majority (71.00%) of the farmers acknowledged that pesticides were harmful to their health and the environment (65.00%). However, farmers' level of knowledge of pesticide safety is insufficient. Over seventy percent of the farmers did not read or follow pesticide label instructions, and 58.00 percent did not use any personal protective equipment (PPE) while handling pesticides. Pankaj (2020) reported that around 72.50 per cent do not have essential knowledge for proper selection of pesticides for particular disease control followed by 60 per cent had lack of knowledge about recommended dose of pesticides. more than half (55.20 per cent) of the respondents use Knapsack sprayer for the spraying, followed by Aspeebollow sprayer and Rotary duster for the pest control by 40.00 and 18.40 per cent. Patel *et al* (2011) reported that more than half (55.20 %) of the respondents use Knapsack sprayer for the spraying, followed by Aspeebollow sprayer and Rotary duster for the pest control by 40.00 and 18.40 per cent.

It can

be concluded from the table that majority of the respondents had used Knapsack sprayer and Aspeebollow sprayer for control of pest. They did not used the low cost methods of pest

**Comment [KM17]:** In above para it is mentioned that farmers has almost 60-70% knowledge in pest identification.

**Comment [KM18]:** Same as above comment

control.Rathwa et al (2021) stated that 74.16 per cent of the cotton growers were from medium level knowledge group with respect to Integrated Pest Management.

**OVERALL KNOWLEDGE ON PESTICIDE USE**

Knowledge on pesticide was studied considering different aspects of pesticides. It was observed that majority (72.50%) of the paddy growers belong to medium knowledge category followed by 18.75 and 8.75 per cent found in high and low category respectively. While, in case of cabbage crop, 38.75 per cent were found in low category of knowledge on pesticide followed by 32.50 and 28.75 per cent in medium and high category respectively. (Table 4,5 and Fig 2, 3). It was observed that majority of the farmers belong to medium to low knowledge category in pesticide use in two crops. As for as scientific method of cultivation is concerned, farmers learn from their parents or friends, there is no formal orientation or training. In case of pesticide use farmers are following either suggestions of their friends or advice of inputs dealers. Hence, they lack knowledge of scientific methods. Pankaj (2020) farmers stated that not have essential knowledge for proper selection of pesticides for particular disease control followed by 60 per cent had lack of knowledge about recommended dose of pesticides. Deviprasad *et al.* (2015) conducted a study on pesticide usage pattern in four districts of Karnataka. The results showed that significant lack of knowledge among the farmers about preventive and proper pesticide application, personal protection and personal hygiene were observed



**Table 1. Education and land holding status of the farmers**

**n=160**

| Sl No | Category | Criteria | Paddy ($n_1$=80) | | Cabbage ($n_2$=80) | |
|---|---|---|---|---|---|---|
| **I** | **Education** | | **f** | **%** | **f** | **%** |
| 1 | Illiterate | No Schooling | 5 | 6.25 | 12 | 15.00 |
| 2 | Primary School | 1st to 4thStd | 20 | 25 | 27 | 33.75 |
| 3 | Middle School | 5th to 7thStd | 30 | 37.5 | 10 | 12.50 |
| 4 | High School | 8th to 10thStd | 12 | 15 | 19 | 23.75 |
| 5 | Pre University/Diploma | 11th and 12th | 8 | 10 | 9 | 11.25 |
| 6 | Graduates | Degree | 4 | 5 | 2 | 2.50 |
| 7 | Post Graduate | Masters | 1 | 1.25 | 0 | 0.00 |
| **II** | **Land holding** | | | | | |
| 1 | Marginal Farmers | < 2.5 ac | 2 | 2.50 | 2 | 2.5 |
| 2 | Small Farmers | 2.5-5.0 ac | 40 | 50.00 | 15 | 18.75 |
| 3 | Semi Medium Farmers | 5.01 – 10 ac | 32 | 40.00 | 20 | 25.00 |
| 4 | Medium Farmers | 10.01 – 25 ac | 3 | 3.75 | 40 | 50.00 |
| 5 | Big Farmers | > 25 ac | 3 | 3.75 | 0 | 0.00 |

Figures in the parenthesis represent percentage f-Frequency % -Percentage

**Table 2. Overall distribution of the farmers based on socio -economic characteristics of farmers**

**n= 160**

| Sl.No | Paddy($n_{1=80}$) | | | Cabbage($n_2$=80) | | |
|---|---|---|---|---|---|---|
| | **Category** | **f** | **%** | **Category** | **f** | **%** |
| **I** | **Cropping intensity** | | | | | |
| 1 | Low(<96.5) | 0 | 0.00 | Low(<202) | 4 | 5.00 |
| 2 | Medium (96.5.-118.76) | 80 | 100.00 | Medium (195-211) | 73 | 91.25 |
| 3 | High (>118.76) | 0 | 0.00 | High(>237) | 3 | 3.75 |
| | **Mean =107.5, SD= 26.51** | | | **Mean= 220, SD =40.1** | | |
| **II** | **Research Extension linkage** | | | | | |
| 1 | Low (<23.67) | 33 | 41.25 | Low(<22.83) | 26 | 32.50 |
| 2 | Medium( 23.67-25.78) | 16 | 20.00 | Medium(23-26) | 33 | 41.25 |
| 3 | High (>25.78) | 31 | 38.75 | High(>25.38) | 21 | 26.25 |
| | **Mean=24.73 , SD =2.49** | | | **Mean=24.11 , SD =3.0** | | |
| **III** | **Resource bases** | | | | | |
| 1 | Low (<8.94) | 9 | 11.25 | Low (<8.69) | 23 | 28.75 |
| 2 | Medium (8.94 to9.83) | 61 | 76.25 | Medium (8.69-9.66) | 43 | 53.75 |
| 3 | High (>9.83) | 10 | 12.50 | High (>9.66) | 14 | 17.50 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Mean = 9.39 , SD= 1.05** | | | **Mean= 9.18, SD =1.13** | | |
| **IV** | **Environmental orientation** | | | | | |
| 1 | Low(<10.42) | 13 | 16.25 | Low (<9.88) | 12 | 15.00 |
| 2 | Medium (10.42- 11.61) | 55 | 68.75 | Medium (9.88- 11.67) | 31 | 38.75 |
| 3 | High(>11.61) | 12 | 15.00 | High (>11.67) | 37 | 46.25 |
| | **Mean =11.02, SD=1.39** | | | **Mean=10.78 , SD =2.10** | | |
| **V** | **Sources consultancy pattern for pesticide use** | | | | | |
| 1 | Low(<19.06) | 7 | 8.75 | Low(<19.68) | 14 | 17.50 |
| 2 | Medium(21-22) | 63 | 78.75 | Medium(19.68-21.47) | 47 | 58.75 |
| 3 | High(>20.08) | 10 | 12.5 | High(>21.47) | 19 | 23.75 |
| | **Mean = 19.57, SD=1.20** | | | **Mean=20.582 , SD =2.10** | | |

Figures in the parenthesis represent percentage f-Frequency % -Percentage

**Table 3. Knowledge of the farmers on pesticide use in selected crops**

**n=160**

| **Sl No** | **Dimensions** | **Knowledge index (%)** | |
|---|---|---|---|
| | | **Paddy ($n_1$=80 )** | **Cabbage ($n_2$=80)** |
| 1 | Pest identification | 69.06 | 57.66 |
| 2 | Pesticide selection | 26.88 | 38.54 |
| 3 | Concentration and application | 96.72 | 82.97 |
| 4 | Types of sprayers and maintenance | 91.25 | 87.50 |
| 5 | Toxicity of pesticides and label signs | 68.59 | 61.09 |
| 6 | Storage, disposal of pesticides and hygiene | 67.86 | 53.57 |
| 7 | IPM practices | 73.75 | 70.00 |
| | **Overall Index** | **73.57** | **64.76** |

**Table 4. Overall knowledge of the farmers on pesticide use in paddy crop**

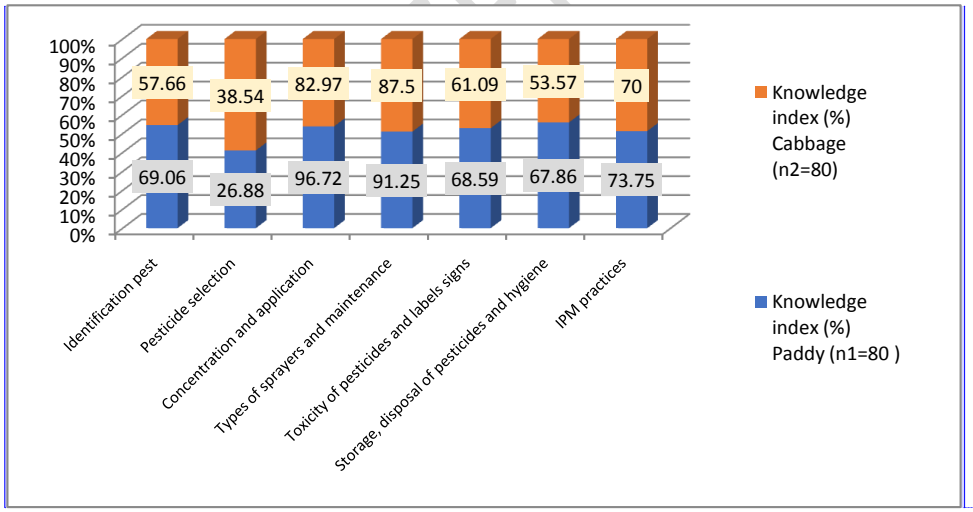
**n=80**

| Sl.No | Categories | f | % |
|---|---|---|---|
| 1 | Low (<55.46) | 7 | 8.75 |
| 2 | Medium (29.4-30.94) | 58 | 72.50 |
| 3 | High (>58.69) | 15 | 18.75 |
| | Mean = 57.08 , SD= 3.79 | 80 | 100.00 |

**Table 5 Over all knowledge of the farmers on pesticide use in cabbage crop**

**n=80**

| Sl.No | Categories | f | % |
|---|---|---|---|
| 1 | Low (<58.44) | 31 | 38.75 |
| 2 | Medium (58.44—63.65) | 26 | 32.50 |
| 3 | High (>63.65) | 23 | 28.75 |
| | Mean =61.05 , SD= 6.14 | 80 | 100.00 |




**Comment [KM19]:** Comparative chart can be used

**Fig.1 Knowledge of the farmers on pesticide use in selected crops**

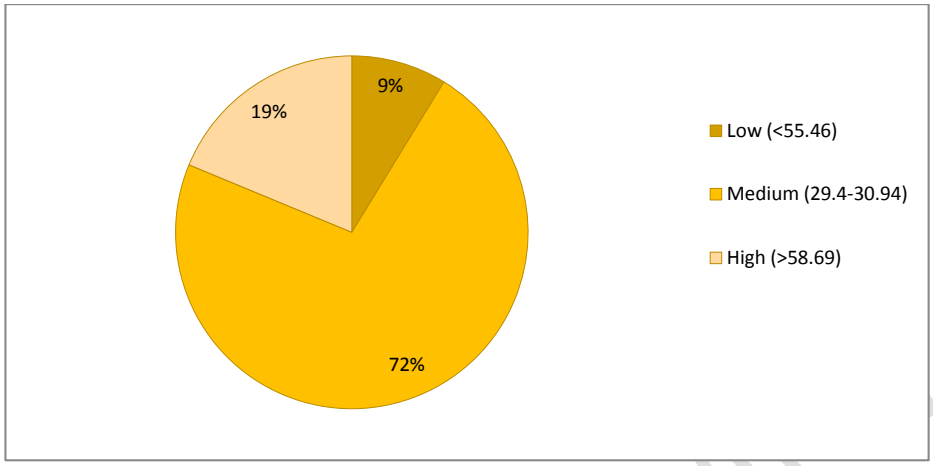



**Fig.2 Over all knowledge of the farmers on pesticide use in paddy crop**

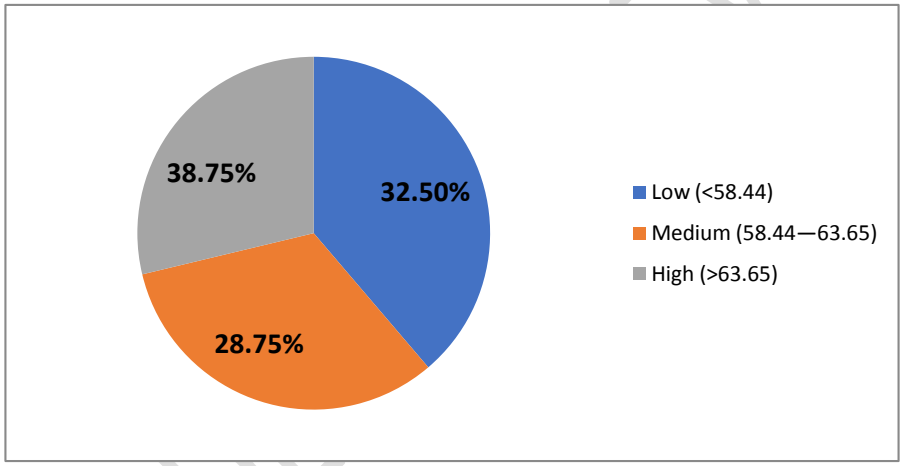



**Fig.3 Over all knowledge of the farmers on pesticide use in cabbage crop**

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