

A STUDY ON MARKET POTENTIAL AND CONSUMPTION PATTERN OF HERBICIDES IN BLACK GRAM OF JAMMU DISTRICT

**by
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(J-21-M-85-ABM)**

**Project submitted to
Faculty of Agriculture
in partial fulfillment of the requirements
for the degree of**

**MASTER OF BUSINESS ADMINISTRATION
(AGRI-BUSINESS MANAGEMENT)**



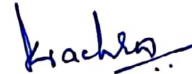
Division of Agricultural Economics and ABM
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2023

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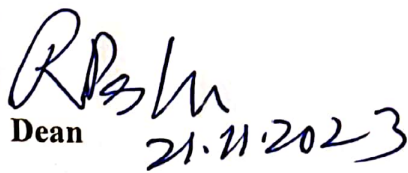
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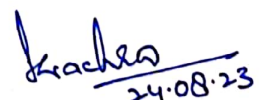
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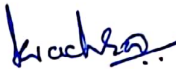
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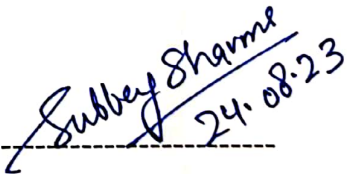
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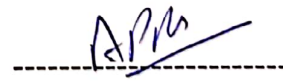

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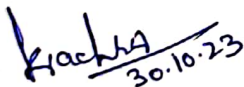


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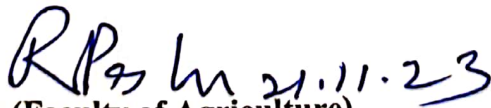


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ABSTRACT

Title of the project : A study on market potential and consumption pattern of herbicides in Black gram of Jammu district

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ABSTRACT

Black gram scientifically known as *Vigna mungo* is a highly prized pulse originating from South Asia. It is extensively cultivated in India particularly in the southern region as well as in Bangladesh and Nepal. India is the largest producer and consumer of black gram contributing about 70% of the world's production. In 2020-21 India produced 2.45 million tonnes of black gram from 4.6 million hectares of land, with an average productivity of 533 kg per hectare. Black gram cultivation accounts for 19% of India's pulse acreage, supporting 23% of the country's total pulse production. The study focused on assessing the market potential and consumption pattern of herbicides in black gram cultivation in Jammu district. The main objectives were to analyse the market potential of herbicides, study the consumption pattern, and understand farmer preferences. Primary data was collected from 60 farmers and 20 dealers in the district. The major herbicide used in the study area was Bayer's Round up (Glyphosate), along with Iris (Pendimethalin) as pre-emergence herbicides. The annual growth rate for these herbicides was 29.61% and 30.75% respectively. In post-emergence herbicides, Agil, Tagpyr, Hakama, and Whip super were consumed by farmers at rates of 35%, 27%, 24%, and 14% respectively. Farmer preferences were influenced by factors such as awareness, affordability, quality, purchasing influence, and other constraints.

Keywords: Blackgram, Herbicide, Market potential, Preference



Signature of Major Advisor



Signature of the Student

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LIST OF ABBREVIATIONS AND TERMS

kg	:	Kilogram
g	:	gram
q	:	quintals
ha	:	hectare
%	:	percent
/	:	per
i.e.,	:	idest (that is)
viz.,	:	namely
no.	:	number
Fig.	:	figure
l	:	litre
&	:	and
<i>et al.</i>	:	and others
df	:	degrees of freedom
Sig.	:	statistical significance
approx.	:	approximately
EC	:	Emulsifiable Concentrate
SL	:	Soluble Liquid
KMO	:	Keser-Meyer-Olkin
KVK	:	Krishi Vigyan Kendra
CAGR	:	Compound Annual Growth Rate
ICMR	:	Indian Council of Medical Research
MAFW Welfare	:	Ministry of Agriculture and Farmers
EPA	:	Environmental Protection Agency
USD	:	United States Dollar
BETS	:	Best Efficacy Targeting Strategy
LAMPs	:	Lake-wide Management Plans

INTRODUCTION

Pulses hold a prominent position in Indian agriculture, primarily due to the significant portion of the population being lactovegetarian (Key *et al.*, 2006). These legumes serve as an essential and economical source of dietary proteins, carbohydrates and micronutrients for fulfilling nutritional demands, and they are especially important for communities in developing nations where consuming animal protein may be expensive. The majority of vegetarians in India depend upon pulses to fulfill their protein needs. Pulses have a dry-seed protein content of 20-25 per cent, which is around 2-3 times more than that of cereals. Therefore, a balanced combination of both cereals and pulses in the diet provides valuable biological value for human nutrition. The Indian Council of Medical Research (ICMR) outlines protein necessities for different age groups, recommending 0.83 grams per kilogram per day for healthy Indian adults, while the average intake remains lower at approximately 0.60 grams per kilogram per day (FAO, 2017). Globally, protein consumption is rising, with an average of 68 grams per person per day, but India exhibits the lowest average at 47 grams per person per day compared to other Asian and developed nations (Abraham *et al.*, 2018).

Black gram (*Vigna mungo* L. Hepper) is one of the most important pulse crops of India, it belongs to the family Leguminosae. It is a widely grown crop around the world, but it is especially popular in Asia where it is an essential of various diets and cuisines. Black gram has substantial market potential due to its versatile uses and nutritional benefits. The need for plant-based protein sources like black gram will continue to grow as the worldwide population expands. Farmers now have an opportunity to increase their revenue and fulfil their demand which has been growing. The consumption pattern of black gram varies across different regions and cultures. Black gram is a common ingredient in dals, curries and snacks in South Asian nations like India, Pakistan and Bangladesh. Additionally, it is an essential ingredient in well-known street dishes. Additionally, people frequently add its sprouts to salads and sandwiches. The consumption of black gram is anticipated to stay constant or perhaps grow as people become more health conscious and look for rich nutrient alternatives. The economic viability of growing black gram stays positive as consumer awareness of its nutritional benefits develops and dietary choices move towards healthier options. To

maximize their financial rewards, farmers should like with any agricultural endeavor, keep up with market trends, use modern cultivation techniques and focus on sustainable practices to maximize their economic gains.

Black gram (*Vigna mungo*) holds significant economic importance at the global level as a versatile and sought-after legume crop. With its wide range of applications and nutritional benefits, black gram plays a crucial role in addressing economic challenges related to food security, trade and agricultural livelihoods worldwide. As an essential component of the pulse industry, black gram cultivation and trade have a substantial impact on the economy, providing opportunities for income generation and employment across various regions. Additionally, its value as an affordable source of protein and other essential nutrients makes it crucial for populations in developing nations, where affordability and accessibility to nutritious food are critical socio-economic factors. The economic aspects of black gram cultivation, trading and consumption on a worldwide scale, underline its importance in promoting agricultural sustainability and the financial security of millions of people. The demand for black gram has been steadily increasing, not only in traditional consumption regions like South Asia but also in other parts of the world. This growing demand is attributed to its versatility in various culinary applications and its reputation as a nutritious and sustainable food option.

The international trade of black gram has expanded significantly in recent years, with various countries participating in both import and export markets. India, as the largest producer and consumer of black gram, plays a crucial role in global trade. It exports significant quantities to meet the demands of other nations, while also importing black gram to satisfy its domestic requirements during periods of low production. The trade dynamics of black gram contribute to economic ties among countries and create opportunities for income generation in rural farming communities.

Black gram originated in South Asia, where it has been in cultivation since ancient times and is one of the most highly prized pulses of India. It is very widely used in Indian cuisines. In India, the black gram is one of the important pulses grown in both the *kharif* and *rabi* seasons. This crop is extensively grown in the southern part of India, the northern part of Bangladesh and Nepal. In Bangladesh and Nepal, it is known as mash daal. It is a popular *daal* (legume) side dish in South Asia, that goes with curry and rice as a platter. Black gram is scientifically known as *Vigna mungo* and is

commonly called Urad in India. India is its primary origin and is mainly cultivated in Asian countries including Pakistan, Myanmar and parts of Southern Asia. About 70 per cent of the world's black gram production comes from India. India is the world's largest producer as well as consumer of black gram. It produces about 24.5 lakh tonnes of Urad annually from about 4.6 million hectares of area, with an average productivity of 533 kilograms per hectare in 2020-21 (AIMC, 2021). The black gram area accounts for about 19 per cent of India's total pulse acreage which contributes 23 per cent of total pulse production.

The pulse crops are normally grown in all ecologies in India. The performance of pulse crops keeping in view the contribution to area and production is better in central India. North West India covers the states of Haryana, Himachal Pradesh, J&K, Punjab, Rajasthan, U.P. and Uttarakhand. Central India states are Chhattisgarh, Gujarat, M.P., Maharashtra and Odisha. The southern region includes the states of Andhra Pradesh, Karnataka, Kerala and Tamil Nadu, whereas the East and North India part covers the states of Assam, Bihar, Jharkhand and West Bengal. Madhya Pradesh, Uttar Pradesh and Andhra Pradesh are major black gram-growing states. The highest yield was recorded by the state of Bihar (898 kg/ha) followed by Sikkim (895 kg/ha) and Jharkhand (890 kg/ha). The national average yield of black gram is 585 kg/ha. The lowest yield was recorded in the state of Chhattisgarh (309 kg/ha) followed by Odisha (326 kg/ha) (Kanth *et al.*, 2021).

In the state of J&K, the average yield of black gram is 385 kg per hectare. As far as the Jammu division is concerned total area under pulses is 8776 hectares, production (45,588 q) and productivity (5.19 q/ha). Among different pulses grown in the Jammu division, black gram covers the maximum area but its production is low. To meet the ever-increasing demand for pulses at the national and state levels, all stakeholders are making concerted efforts to accept the challenge by adopting various interventions/ new techniques of pulse production. The area under pulses in the Jammu division falls under Samba and Kathua which shares 2278 and 1961 hectares under pulses. The area coverage of the black gram crop in Jammu district was 1091 hectares and yield was 0.34 tonnes per hectare in 2019-2020 (MAFW, 2021).

Among various production factors, weed plays a vital role in influencing black gram yield. Weeds compete with resources like nutrients, moisture and light. High temperature coupled with frequent rains during the growing period infests the crop

heavily with weeds which adversely affect the productivity of this crop. An initial period of 20-40 days is very critical (Saraswat and Mishra,1993). The yield loss of black gram due to weeds has been reported to the extent of 27 to 90 per cent depending upon the type and intensity of weed flora (Kumar *et al.*, 2000).

Herbicides are chemicals that are used to destroy or control undesirable plants, sometimes known as weeds. They are commonly employed in agriculture, forestry, horticulture and landscaping to control weed growth, safeguard crops and preserve valuable vegetation. Herbicides function by interfering with a variety of physiological processes in plants, which eventually result in their demise. Herbicide usage is widespread since it is essential to modern agriculture and the control of weeds. The International Survey on Herbicide-Resistant Weeds published a paper stating that herbicides are the most effective way to manage weeds, making up around 90 per cent of all pesticides used all over the world. Globally, the drive for higher food production and efficient weed control has led to a large rise in the usage of herbicides throughout time. It is significant to note that countries and areas might have different particular statistics on herbicide usage.

Different nations use herbicides in different ways. The United States, Argentina, Brazil, Canada, China and India are a few of the top herbicide-using nations. Herbicides are widely employed in the sizable agricultural sectors of these nations. One of the most frequently used herbicides in the world is glyphosate. It is a broad-spectrum herbicide that is used to eradicate several weed species. Glyphosate is categorized by the International Agency for Research on Cancer (IARC) as “probably carcinogenic to humans”. However, regulatory bodies like the United States Environmental Protection Agency (EPA) have insisted that the use of glyphosate in accordance with the recommendations on the label is safe.

The market for herbicides has been expanding consistently on a worldwide scale. The worldwide herbicides market was estimated to be worth 30.32 billion in 2023, and it is anticipated to grow to 40.84 billion USD by 2028 at a CAGR (6.14%) during the forecast period for 2023-2028 (MIR, 2023). The global herbicides market size is valued at 39.06 billion USD in 2022 and is predicted to reach 71.15 billion USD by the year 2031 at a CAGR (7.05%) during the forecast period for 2023-2031 (GHMR, 2023).

Over 39 thousand metric tonnes of herbicides were imported into India during the fiscal year 2021, a rise from the prior year. A rise in imports in fiscal year 2019 was caused by a decline in the nation's herbicide production quantities due to irregular rainfall in crucial agricultural areas and low-price realization for significant crops. Nearly 78 thousand metric tonnes of herbicides were exported from India to foreign nations during the 2020 fiscal year, a reduction from the previous year. By the end of the fiscal year 2020, the volume of agrochemicals produced in the nation was projected to increase by 6 per cent with the aid of government subsidies and financial assistance (Statista, 2023).

THE PROJECT

2.1 Title and Statement of Project

The project work entitled “**A study on market potential and consumption pattern of herbicides in Black gram of Jammu district**” was carried out in different area of Jammu district of UT J&K during the year 2022-23.

This project aims to study the market potential and consumption pattern of herbicides especially in the context of growing black gram (*Vigna mungo*). The significant pulse crop ‘black gram’, commonly referred to as “*urad bean*” or “*black lentil*”, is grown in a variety of agroclimatic areas. Its economic importance, nutritional value and adaptability in many cuisines highlight the importance of efficient crop management techniques. The effective management of crops and the optimization of yield have emerged as the two most important challenges in the constantly changing world of modern agriculture. The proper application of herbicides has a key position among the various factors affecting crop productivity. Herbicides are essential for managing weed infestations and ongoing challenges for farmers that may negatively impact crop development and productivity. This study aims to provide useful insights into the following crucial areas by thoroughly examining the market dynamics and consumption patterns of herbicides in black gram cultivation:

- 1. Market potential:** Understanding the importance of the herbicides market, either present and in the future, for the black gram industry. This involves studying elements including market participants, supply chains, pricing schemes and market dynamics.
- 2. Consumption pattern:** To study the common usage patterns of herbicides among black gram growers. This includes analysing the preferred herbicide classes, application techniques, frequency of usage and effects on crop health and yield as an entire.
- 3. Economic implications:** Analysing the financial effects of herbicide usage in black gram farming, considering into account the impact on input costs, crop production and total farmer profitability.

- 4. Sustainability and environmental considerations:** Analyzing the ecological effect, potential risks and use of integrated weed control techniques to determine the viability of herbicide use in black gram farming.
- 5. Recommendations and future outlook:** Providing well-informed suggestions for improving herbicide usage in black gram production based on a study of market potential and consumption patterns. In addition, taking into consideration potential challenges and possibilities for sustainable crop management.

2.2 Farmer's Perception of Selection of Herbicides

Farmer's perception is the study of how a person chooses one product over another and what factors influence that decision. The marketers attempt to recognize the actions of the farmers in the market and the underlying motives for those actions. These motives are the factors that impact the farmer's perception:

- 1. Economic and socio-cultural importance:** Investigating the economic viability of black gram cultivation, along with its social and cultural significance, will offer insights into the crop's contribution to the livelihoods of farmers and the preservation of traditional culinary heritage.
- 2. Benefits of herbicides:** Herbicides are useful in agricultural practices in a number of ways. By reducing weed competition for resources like nutrients, water and sunlight, they assist in boosting crop yields. Herbicides also help with conservation tillage by lowering the need for mechanical weed management techniques, reducing soil erosion and enhancing soil health.
- 3. Affordability:** Herbicide cost relative to the farmer's budget can influence selection. When choosing herbicides, farmers frequently take into account both their price and the possible influence they may have on crop productivity.
- 4. Environmental impact:** Herbicide use can have an impact on the environment even while it has benefits for controlling weeds. Herbicide misuse or abuse can have detrimental effects on beneficial insects, non-target plants, animals and water bodies in addition to degrading the soil. To reduce these hazards, it is crucial to use herbicides wisely and sensibly while adhering to the correct standards and laws.

5. Regulation and safety: To guarantee their safe and responsible usage, herbicides are subject to regulatory frameworks and standards in many nations. Before approving the use of herbicides, regulatory bodies like the Environmental Protection Agency (EPA) in the US analyse the safety and effectiveness of the chemicals. Comprehensive research and analyses of possible dangers to human health and the environment are part of these evaluations.

6. Guidelines and safety precautions: Indian farmers and herbicide users are encouraged to abide by the instructions and safety measures listed on the product labels. This entails using protective gear (such as gloves, goggles and masks) when handling and applying herbicides, following dose and timing guidelines and upholding correct storage and disposal procedures.

2.3 Objectives of the study

1. To estimate the market potential of herbicides used in Black gram crop in the study area
2. To study the consumption pattern of herbicides under Black gram in the selected area
3. To study the farmer's preference for herbicides in Black gram

2.4 Scope of the study

- a. The study helped to estimate the market potential for herbicides used in black gram crops in the study area, as well as the consumption patterns of herbicides used in black gram crops in the selected area and the preferences of farmers for using herbicides in black gram.
- b. The study was helpful in identifying major players in the market and from farmer's views regarding herbicides of black gram.
- c. This study also provided insight into how farmers select their herbicides for black gram crops.
- d. Additionally, it was helpful in determining the value measures to be adopted for enhancing the herbicide market potential.

2.5 Limitations of the study

- a. The study is only linked to the farmers from certain areas of Jammu and therefore, the findings may not be a true representation of all.
- b. The respondents may be biased towards some questions which also may lead to an incorrect or distorted view of the actual situation.
- c. Some of the respondents were not ready to give the responses.

REVIEW OF LITERATURE

It is always necessary to analyse the research work already done in a particular field for the systematic development of science. Therefore, it is necessary to reconsider the research work already done, related with the **“A study on market potential and consumption pattern of herbicides in Black gram of Jammu district”**. To make the study more rational and useful a review of the research findings is given below:

3.1 To estimate the market potential of herbicides used in Black gram crops in the study area

Kraehmer (2012) found agrochemical firms develop their research programmes based on a variety of factors, including agronomic requirements or customer demand for agricultural products, market estimate, regulatory limitations, corporate strength and specific business portfolio demands. Herbicides have been an essential instrument for farmers in industrialised countries for more than 50 years. Due to challenges including high labour costs, energy prices, erosion as an environmental concern and competition, herbicides currently hold a prominent position in the agrochemical industry. Farmers globally spent more than \$17 billion annually, or more than 40 per cent of all pesticide spending, on herbicides in 2010. Herbicide development used to get substantial financial support from every research-driven pesticide company. Over the past ten years, top companies have invested between \$100 and \$300 million in herbicide research and development each year.

Sondhia (2014) conducted a study on the use of herbicides is expanding globally as a result of rising labour costs, a wider variety of herbicide applications, and rapid weed control in both agricultural and non-crop regions. Over the past ten years, India has seen a 30 per cent increase in the usage of herbicides. Numerous herbicides are discovered as bonded residues, rendering them not only ineffective against the intended targets but also degrading the soil environment in various ways. Therefore, it is crucial to monitor these residues in soil, water, plants, fish and other matrixes. Herbicide breakdown in the soil is influenced by a variety of mechanisms, including adsorption, absorption, volatilization, leaching, runoff, photodecomposition and microbiological and chemical reactions. Herbicides were either below the maximum residue level or

below detectable limits in a variety of commodities during harvest. Herbicides seldom have indirect effects in India. However, a growing number of cases of acute poisoning caused by several herbicides, including glyphosate, butachlor, fluchloralin, paraquat, 2,4-D and pendimethalin, are becoming an issue in India. The study concluded that herbicide contamination of soil, plants and natural waterways is rare and occurs at low levels in India.

Ahlawat *et al.* (2016) in their study showed the district of Jammu's pesticide market share. Vegetables are planted across a 63.10 thousand hectares area in Jammu and Kashmir, with an average productivity of 22.10 million tonnes per hectare and an annual production of 1395.50 thousand million tonnes, which is greater than the national average of 17.60 million tonnes per hectare. Insecticides now hold the majority of the pesticide market share, accounting for 65 per cent of all pesticide demand, followed by fungicides and herbicides. Insecticide India Limited, with a share of 14.98 per cent, leads the market in the sale of the insecticide Nuvan, followed by two types of products with shares (14.11% and 11.97%), respectively. In the market for fungicides, Indo FIL is in first place with a market share of 17.38 per cent for the sale of M-45 Juba, while Monsanto is in first place in the market for weedicides with a share of 17.27 per cent. Retail trader influence, company representative influence and on-farm demonstration are the main factors influencing farmer's purchase of pesticides. According to a survey of farmers in the Jammu district, 86.67 per cent of respondents were aware of Bayer Crop Science, followed by 75.70 per cent of Monsanto, 66.67 per cent of Crystal, 62.67 per cent of Dupont, 55.00 per cent of Syngenta and FIL and 40.70 per cent of UPL.

Devaraju and Senthivel (2017) study suggested a strong market potential for the identified herbicide combination (Pendimethalin and Imazethapyr) in black gram cultivation in the study area. The high weed control efficiency, improved yield attributes and substantial economic returns demonstrate the effectiveness and economic viability of this herbicide treatment. Farmers in similar agro-ecological regions could consider adopting this approach to enhance their black gram production and increase their income.

Deep *et al.* (2021) conducted a study in the Samba district of Kandi belt (water scarcity) of J&K during the agriculture year 2016-17 where cultivation of pulses is generally practiced by the farmers for livelihood security. The marketing of the three

major pulses i.e., urad bean, mung bean and gram involved three different types of channels: producer-village trader-wholesaler-retailer-consumer (Channel-I), producer-wholesaler-retailer-consumer (Channel-II) and producer-consumer (Channel-III). This information was discovered after selecting a sample of 120 farmers using the multistage sampling technique. Channel-III, followed by Channel-II and Channel-I, had the highest marketing effectiveness for all of the major pulses (3.11 for black gram, 6.47 for mung bean and 05.98 for gram). This suggests that the maximum marketing effectiveness in various channels occurred when there was no marketing middleman between farmers and customers and the product was sold straight from producer to consumer. Further research revealed that the absence of fair market prices, an unorganized market, high transportation costs and a lack of market knowledge were the main marketing barriers to the sale of key pulses in the study region.

Mugandani *et al.* (2021) in their study focused on the use of herbicides on several pulse crops, including black gram. Herbicides in pulses are discussed together with market trends, obstacles and prospects, with a focus on their function in environmentally friendly weed control. The effectiveness of herbicides, the safety of crops and their effects on production and profitability are discussed by the writers.

Sharma *et al.* (2021) conducted a comprehensive study on the market potential of herbicides for weed control in black gram crops. The research examined the efficiency of several herbicide formulations in controlling significant weed species. According to the study findings, herbicides like Pendimethalin and Imazethapyr had promising effects on weed control and crop productivity. The study also emphasised the financial advantages of herbicide treatment, making it a realistic choice for black gram producers.

Taherali *et al.* (2021) the goal of the current study was to evaluate the market potential and market share of Vimax Crop Science's crop care products in the key crops to offer a viable strategy for accelerating the expansion of its business. The study used a multistage sampling strategy. Twenty business dealers scattered across twelve blocks of the district were randomly chosen to provide the necessary information. The result also showed that extensive advertising efforts and adaptable loan conditions were the main variables influencing the improvement of sales. Dealer satisfaction with the company's loan conditions, pricing and timely availability was determined to be lower. A clever strategy on the side of the corporation to reach every farmer in rural locations

with awareness, execute crop advising campaigns and offer more flexible finance terms with timely availability of the products will assist in fueling the company's growth.

Parasuraman *et al.* (2022) their study revealed that herbicides are a useful tool for controlling weeds when used properly, they may cut down on output losses caused by weeds by up to 13 per cent. The study's objective was to evaluate farmer's herbicide purchasing habits, market potential and purchasing challenges. 200 farmers were the sample size for the study, which was conducted in 2021 in a few Tamil Nadu districts. According to the study's findings, there is a 1 per cent significant correlation between the farmer's demographic traits and their preference for weeding activities. The global herbicide market is anticipated to expand at a CAGR of 2.1 per cent from 2020 to 2025 according to Mordor Intelligence Report (2022).

Sathi *et al.* (2022) in their study revealed the profitability and effectiveness of several herbicides used in the production of black gram. It goes through various weed species, treatment techniques, doses and how they affect crop productivity. The authors offered information on the market potential for herbicides and how they work with other weed control techniques.

3.2 To study the consumption pattern of herbicides under Black gram in the selected area

Nordblom *et al.* (2003) examined the economic implications of using fixed-label herbicide doses versus a flexible approach known as the "best efficacy targeting strategy" (BETS) in weed management. BETS involves adjusting herbicide application rates based on current weather conditions and weed density. To study this, the authors develop a bioeconomic simulation model that integrates an herbicide efficacy model, water balance, wheat yield, yield loss and weed seed bank dynamics models.

Haggblade *et al.* (2017) conducted a study on the recent fast growth in herbicide usage in the developing world that has been fueled by two significant shocks to the global supply networks. At the same time as rising low-cost Asian suppliers have mastered herbicide production methods, built up production capacity and dramatically reduced production prices, a flood of off-patent herbicide formulations has entered the market. Together, they have lowered herbicide prices and expanded availability in farming communities throughout the developing globe. Herbicide usage has reacted quickly in areas where non-farm and urban job options are pushing up rural pay rates.

Herbicide use has increased dramatically in recent years, particularly since 2005, in nations as different as China and Ethiopia. The six case studies included in this special issue, which focus on the USA, EU, China, India, Ethiopia and Mali, explore the variations in herbicide adoption timing, major motivators, and outcomes in these wide-ranging international contexts.

Choudhury *et al.* (2018) conducted a comprehensive study on the potential, risks, and trends related to the consumption of herbicides in Indian agriculture. The researchers looked at how herbicides were used in various parts of India and emphasised the factors that affected this. The study highlighted the demand for sustainable pesticide use and suggested tactics for successful weed control.

Kumar and Singh (2018) this research examined the distribution of herbicide use across India and evaluated how it affects weed control. The writers highlight the growing use of herbicides and go into the variables affecting their use. Additionally, they assess the efficiency of herbicides in controlling weeds and emphasise the difficulties brought on by herbicide resistance. The study outlines insights into the existing consumption pattern of herbicides in India.

Verma and Singh (2019) studied ten-year patterns in pesticide use in Indian agriculture. The author examines how farmer's attitudes about herbicides are evolving and talks about what is behind the rise in demand. They evaluated the effects of pesticide usage on soil health, weed flora and crop yield. The study emphasises the necessity of developing integrated weed management tactics in India and using herbicides sparingly.

Yadav and Dutta (2019) due to its ability to guarantee both food security and a means of subsistence, agriculture is India's most significant economic sector. Numerous agrochemicals, such as fertilizers, insecticides, micronutrients and plant growth regulators, are now widely used in agricultural areas as a result of industrial agriculture. The use of pesticides in contemporary agriculture is essential. Pesticides are used in agriculture to avoid crop-damaging pests, fungi, undesirable plants (weeds) and a variety of crop-eating animals like rats and other small animals. The goal of the current study was to examine pesticide consumption patterns, farmer knowledge of safe pesticide handling and application techniques and farmer practices related to pesticide use. 500 farmers participated in extensive field surveys that were supplemented by

focus groups, interviews, questionnaires and field observations. The findings revealed that insecticides made up the majority of the pesticide consumption pattern, followed by herbicides and fungicides.

Choudhary and Sharma (2021) examined the use of herbicides in different Indian states. The study used statistical methods to analyse the trends and variability in herbicide consumption and secondary data from the market for agricultural inputs. The study clarified the geographical variations in herbicide use and pinpointed the causes of the various consumption patterns.

Maino *et al.* (2023) studied that agricultural systems, insecticides, herbicides and fungicides are commonly used to boost yields by managing pests, weeds and diseases. However, these chemicals also pose risks to health and the environment. While pesticide usage data is crucial, many countries lack it. This study explored whether pesticide registration databases, which are more widely available and structured, can help predict pesticide usage patterns. Using data from the US and Australia, the research showed that these databases can explain a significant portion of usage variation (56% in the US and 38% in Australia). In the context of herbicides, more registered products, pests and products for a specific active ingredient were linked to higher usage. This suggests that these databases can aid in estimating herbicide usage trends, which is valuable for countries with limited data. However, some usage variations remain unexplained, emphasizing the need to consider additional factors.

3.3 To study the farmer's preference for herbicides in Black gram

Sivakumar (1994) observed that the farmers mainly depend on private dealers for the purchase of pesticides. For the majority of the section, farmers buy pesticides from private dealers. The main sources of information on dealers were friends, neighbours and relatives; in the case of brands, it was extension staff from the Department of Agriculture. Brand loyalty was greatly influenced by the company's prices, qualities and advertising. Dealer loyalty was greatly influenced by the availability of loans, advertising, and competitive pricing of pesticides from the dealer.

Richards *et al.* (1996) study focused on determining the loading rates of several herbicides (atrazine, alachlor, cyanazine, metolachlor and metribuzin) into Western and Central Lake Erie from 1983 to 1993. These loading rates were important for various reasons, including the development of Lake-wide Management Plans (LAMPs),

understanding the herbicides dynamics and their impact on human and ecosystem health in the Great Lakes, and assessing agricultural pollution management on a regional and national scale. The Beale Ratio Estimator was used to calculate the loads, and the result showed substantial variability in annual loads, influenced by factors like rainfall and river discharge following herbicide application.

Kool *et al.* (1997) studied farmer's purchasing procedures, focusing on the choice of a provider for a particular agricultural input. The relationship with suppliers and the style of farming are significant explanatory factors for the length of the purchasing procedure. Their findings support the enrichment theory in relation to product knowledge and the psychology of simplification theory with regard to farmer's purchasing choices.

Sivakumar and Sivakumar (2004) studied that herbicides were developed and put to use primarily to replace laborious, physically taxing hand weeding and reduce the amount of time needed to complete weeding tasks. Herbicides are now the farmer's go-to method for weed management due to ever-rising labour and gasoline prices. Utilizing herbicides has its own advantages. Even before weeds appeared, herbicides could keep them under control. Herbicides have proven particularly successful on crops that were spread-seeded and grown in small rows. Herbicide effectively eradicated all weeds inside a row of broad-row crops without harming the adjacent crops. It may eliminate weeds that escaped manual weeding efforts and look similar to the crop. Herbicides have the potential to stop weed growth for a long time after application. However, the use of herbicides depended on the technical knowledge of the farmer regarding herbicides and their application.

Maitra *et al.* (2021) studied that herbicides were developed and put to use primarily to replace laborious, physically taxing hand weeding and reduce the amount of time needed to complete weeding tasks. Herbicides are now the farmer's go-to method for weed management due to ever-rising labour and the cost of fuel. Herbicides have been particularly successful on crops that were spread-seeded and grown in small rows. Herbicides have the potential to stop weed growth for a long time after application. However, the farmer's knowledge and awareness regarding herbicides, as well as their desire to use them.

Babu *et al.* (2012) conducted in South India focused on understanding farmer preferences for agricultural information and extension services. It highlighted distinct information-seeking behaviours among farmers, categorizing them into high, medium, semi-medium and low searchers. This customization of information delivery was found to be crucial for effective extension programs. The study also revealed that farmers preferred interpersonal contacts and mobile phones for information dissemination. Relating these findings to herbicide use, the study suggested that tailored extension efforts can impact herbicide selection, adoption, proper application, risk management, economic considerations and resistance prevention. By aligning information delivery with diverse preferences, extension services can enhance farmer's knowledge and practices related to herbicides, leading to more sustainable and effective agricultural approaches.

Hasing *et al.* (2012) examined how label information affected American farmer's decision to use pesticides. A mixture logarithm model is used to estimate farmer preferences for various herbicide features based on the herbicide selections made by U.S. soybean farmers and it is noted that the hazards associated with pesticides to human health and the environment play a significant role in herbicide choice. We discover that farmers are ready to pay an average of 38 USD per acre to refrain from applying herbicide labelled with the phrase "Danger".

Mishra *et al.* (2013) revealed a wide range of factors influenced advertising, which among other things had a significant impact on farmer's purchasing habits. Farmers were aware of the different brands and businesses as a result of advertising initiatives. The pamphlets, brochures, newspapers, magazines and billboards were discovered to be the media that farmers wanted to consume the most. An important component of marketing for agrochemicals was sales promotion. The use of sales marketing techniques including demonstrations, field trips and get-togethers to get farmers to purchase their goods is rapidly expanding.

Pravin *et al.* (2020) the purpose of the study, "Consumer Behaviour and Satisfaction Level Towards Herbicide" in Junagadh and Rajkot District of Gujarat, was to determine how pleased farmers were with the herbicides they used, how they felt about the herbicides themselves, and what variables influenced their purchasing decisions. The data analysis included multiple regression and Lickert's scale. Most farmers have favourable opinions towards herbicides. It was discovered that the

cropping area, brand image and experience all had favourable and significant coefficients. The advertisement coefficient was shown to be negative and significant. The result showed that the majority of farmers in the study area were satisfied with the herbicide's pricing, brand image, availability and efficacy with moderate and high satisfaction levels with quality coming next.

Wendin *et al.* (2020) their study revealed that consumers and farmers are showing a rising interest in heritage cereals and pulses. These developments support local crop production and sustainability. Spelt is the most popular kind and it has made room for ancient indigenous peoples like Oland wheat. Compared to current kinds, heritage grains have demonstrated greater resilience and they may be able to supply the market with goods that are different but still have appealing cultural histories. The market for delicious and wholesome goods made from heritage grains is expanding. The purpose of this study was to examine and assess the perceptions, attitudes and consumer preferences of various groups towards historical cereals. Women are more interested in the origin of the cereal than males and older customers are more worried about its health-related characteristics. Additionally, compared to younger customers, older consumers are more likely to spend more on heritage cereal.

RESEARCH METHODOLOGY

A methodology is usually a guideline system for solving a problem, comprising of specific elements such as categories, tasks, methods, techniques and tools. The purpose of this project was to study the marketing and consumption of herbicide in black gram of Jammu district. The study under consideration is entitled “**A study on market potential and consumption pattern of herbicides in Black gram of Jammu district**”. The sampling area and tools used during this research are described in this chapter.

4.1 Locale of the study

The study was conducted in the Jammu district of the union territory of J&K. Jammu district had covered the highest area under black gram, so it was taken purposively on the basis of five years highest average area. Akhnoor block & Marh block were selected randomly from the Jammu district.

Table 4.1: District-wise area under black gram crop of J&K

S. No.	District	Area (Hectare)					Average
		2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	
1	Doda	144	495	706	531	286	432.3
2	Jammu	2491	2665	2524	3726	1091	2499.4
3	Kathua	1801	1785	2867	2846	2529	2365.6
4	Kishtwar	519	539	539	205	524	465.2
5	Poonch	7	6	6	7	7	6.6
6	Rajouri	233	196	192	448	316	277.0
7	Reasi	126	326	68	113	65	139.6
8	Sambha	2269	2168	1867	1706	2000	2002.0
9	Udhampur	1289	1446	1446	1226	1446	1370.6

(Source: Ministry of Agriculture and Farmers Welfare 2021)



Fig. 4.1 Map of UT Jammu and Kashmir

4.2 Sample size and sampling method

Multi stage sampling method was applied for the present study and the sample size consisted of 60 farmers and 20 dealers.

4.3 Selection of Villages

Four villages were selected from Akhnoor block and Marh block i.e. (Balgara and Payan) & (Chak Kalasey and Gho Manhasan).

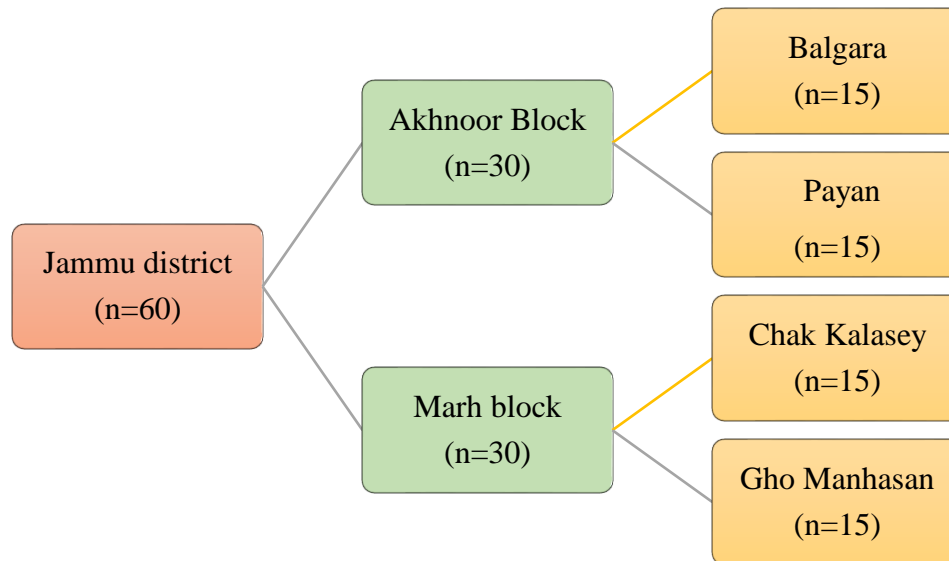


Fig. 4.2: Sampling Design

4.4 Data Collection

The data collection is the method to collect important information to keep on record for further use, to make important decisions about different issues and is of vital significance for others. The present study adopted both the primary as well as secondary data collection techniques.

Primary Data: It involved the first-hand information collected through

- Schedule/ questionnaire method
- Direct personal interview method

Secondary Data: The data that had already been published, compiled and presented earlier by any agency was used for purpose of investigation. The data has been collected through various websites, journals, research papers, journals related to brand and advertisement, newspapers, magazines etc.

4.5 Statistical Tools

For analysis of data, statistical tools such as descriptive tables; compound annual growth rate, percentage analysis, factor analysis and Garrett's ranking technique were adopted.

4.5.1 Compound Annual Growth Rate

Compound Annual Growth Rate (CAGR) is the average rate at which a specific amount (investment) grows over time and assuming the value which has been compounded over this time.

$$\text{CAGR} = \left[\left(\frac{V_2}{V_1} \right)^{1/N} - 1 \right] \times 100$$

Where,

V_2 = Final Value After N Years

V_1 = Initial Value

N = No. of investment times (months, years, etc.)

4.5.2 Percentage analysis

Percentage analysis was used to study the consumption pattern of herbicides under black gram

$$\text{Percentage} = \frac{x}{y} \times 100$$

Where,

x = Number of respondents who respond

y = Total number of respondents

4.5.3 Factor Analysis

For this, we have used factor analysis by using SPSS. Factor analysis is a very useful method of reducing data complexity by reducing the number of variables being studied. The present study used a factor confirmatory test to minimize the large number of variables into meaningful and correlated. There are two stages of factor analysis.

Stage 1 can be called the factor extraction process. At this stage, the aim is to identify the number of factors that can be extracted from the data. The most important popular method used in the present study is principal component analysis. On the basis of components of values approximately to the amount of variance explained by the factor.

Stage 2 is called the rotation of the principal component matrix. This is done to identify which factors are associated with the original variable. The factor matrix provides us with the loading value and a value close to 0 represents low loading. In the present contribution the variables with loading

Weight of 0.60 and above was taken into consideration following equation has been adopted to analyse the factor for meaning analysis.

$$F = W = W_1X_1 + W_2X_2 + \dots + W_KX_K$$

Where,

F= estimate of factor

W_1 = Weight/factor score coefficient

X_1 = Standardized variable

K= No. of variables

4.5.4 Henry Garrett's Technique

With this technique, the percentage of each level obtained is converted into scores according to the table provided by Henry Garret. Then for each item the scores of individual respondents are added together and divided by the total number of respondents added scores.

$$\text{Percentage position} = 100 (R_{ij} - 0.5) / n$$

Where,

R_{ij} = Rank

N = Number of items

After calculating the percentage position garret prices are allocated according to the Garrett table. The factor was calculated by multiplying the value of each column with their Garrett Value. The average rate was calculated by adding the values that were in each row. The average score was calculated by dividing total points by 100. Then the object with the highest value was given the highest rank respectively.

RESULTS

The result pertaining to the present study “**A study on market potential and consumption pattern of herbicides in Black gram of Jammu district**” have been presented in this chapter along with appropriate tables and figures.

Multi-stage sampling technique was adopted for the selection of respondents. Total number of 80 respondents (60 farmers, 20 dealers) were surveyed who gave valuable information. The collected data was analysed by using tabular analysis (compound annual growth rate, percentage analysis, factor analysis and garret ranking) to arrive at meaningful conclusions.

5.1 Socio-demographic profile of farmers

5.2 To estimate the market potential of herbicide used in Black gram crop in the study area

5.3 To study the consumption pattern of herbicides under Black gram in the selected area

5.4 To study the farmer’s preference for herbicides in Black gram

5.5 Socio-demographic profile of dealers

5.6 Importance of different parameters by the dealers

5.7 Ranking of promotional activities of herbicides by the dealers

5.1 Socio-demographic profile of farmers

5.1.1 Age

The data presents in Table 5.1 and Figure 5.1 revealed that the majority of the farmers i.e., 50 per cent belonged to above 56 age group followed by 25 per cent in the age group 46-55 years and rest 25 per cent belonged to below 45 years age group.

5.1.2 Education

The table and figure further revealed that majority (37%) of the farmers were matriculates, 30 per cent had primary level education, 18 per cent had middle level, 12 per cent had senior secondary level and three per cent of the farmers had education up to graduation level.

5.1.3 Gender

From the same table and figure majority of (88%) the farmers were males whereas, 12 per cent of the farmers were females who were heads of the families.

Table 5.1: Socio-demographic profile of farmers

(n=60)

S. No.	Group	Number of Farmers	Percentage %
1	Age group (in years)		
A	Below 45	15	25
B	46-55	15	25
C	Above 56	30	50
	Total	60	100
2	Education		
A	Primary School	18	30
B	Middle School	11	18
C	High School	22	37
D	Senior Secondary	07	12
E	Graduation	02	03
	Total	60	100
3	Gender		
A	Male	53	88
B	Female	07	12
	Total	60	100

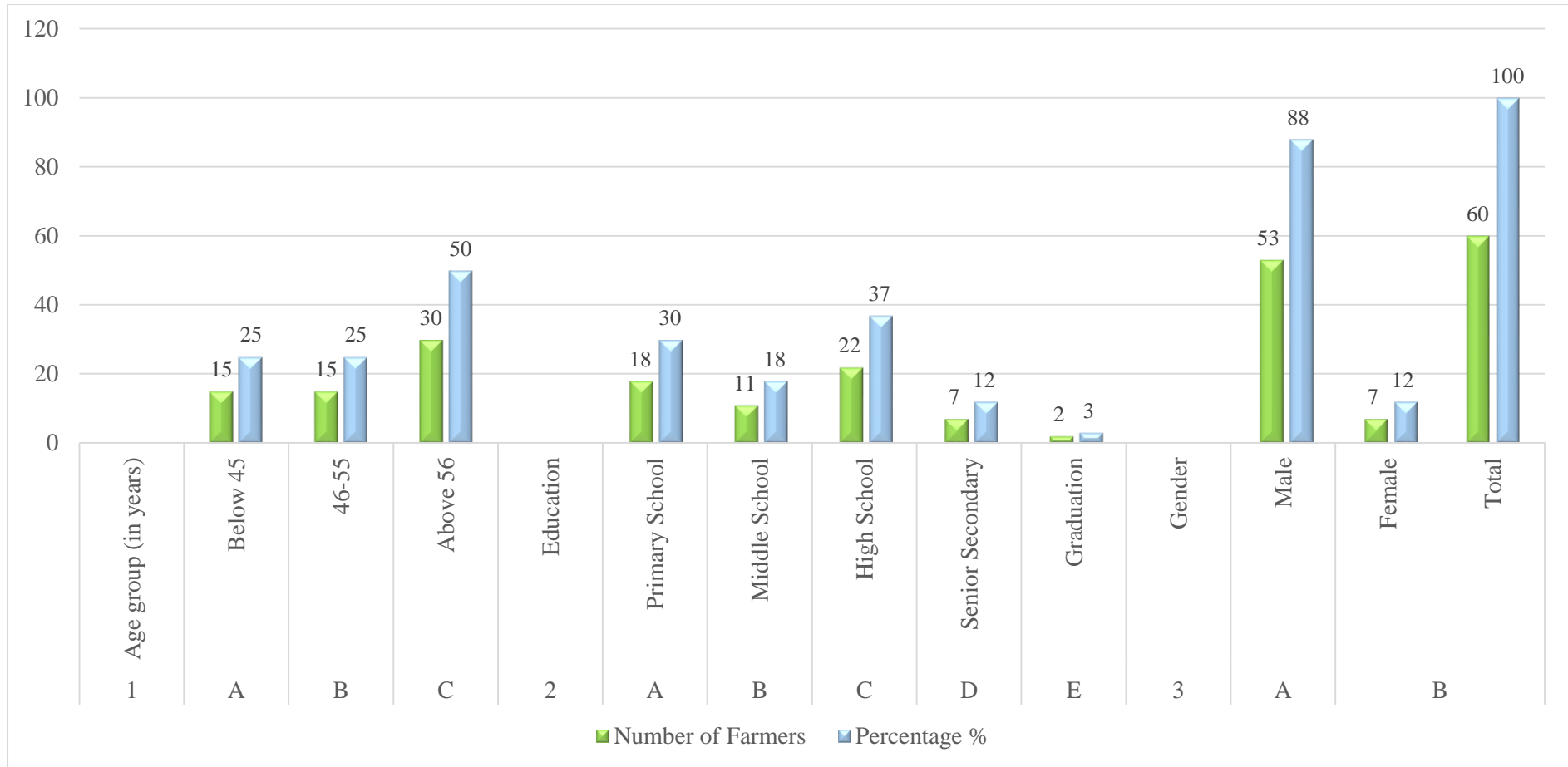


Fig. 5.1: Socio-demographic profile of farmers

5.1.4 Farmers' land holding

Table 5.2 and Figure 5.2 represent the land holdings of the farmers. The total area of all the respondents was 105.81 hectares. Out of which 4.80 hectares was under irrigation whereas, the unirrigated area was 7.33 hectares. The table further clarified that 93.68 hectares of land among the sampled and households were both irrigated and unirrigated which made clear that majority of the farmers had mixed type of land holding (both irrigated and unirrigated).

Table 5.2: Farmer's land holding area

(n=60)

Land holding	Area (ha)	No. of Farmers	Percentage
Irrigated	4.80	06	10
Unirrigated	7.33	12	20
Both Irrigated and Unirrigated	93.68	42	70
Total	105.81	60	100

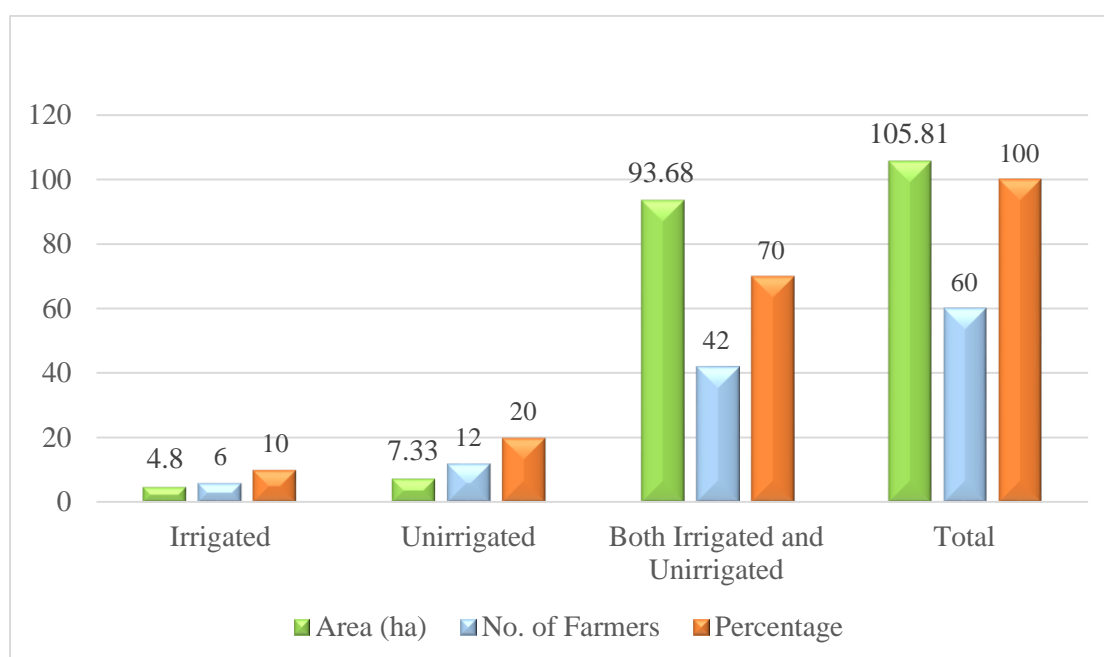


Fig. 5.2: Farmer's land holding area

5.1.5 Category-wise land holding

Table 5.3 and Figure 5.3 represent category-wise land holdings of the farmers. The majority (40%) of the farmers were marginal farmers having an area of less than

1 hectare whereas, 32 per cent of the farmers belonged to small farmers group having area of 1-2 hectares, 20 per cent of the farmers belonged to medium farmers category having area 2-4 hectares and eight per cent of the farmers were from the large farmers group having area more than 4 hectares. Thus, maximum percentage (40%) of farmers were marginal farmers and least percentage (8%) were large farmers.

Table 5.3: Category wise land holding

(n=60)

Farmers' Land Holding	Number of Farmers	Percentage (%)
Marginal Farmers (Less than 1ha)	24	40
Small Farmers (1-2 ha)	19	32
Medium Farmers (2-4 ha)	12	20
Large Farmers (More than 4 ha)	5	8
Total	60	100

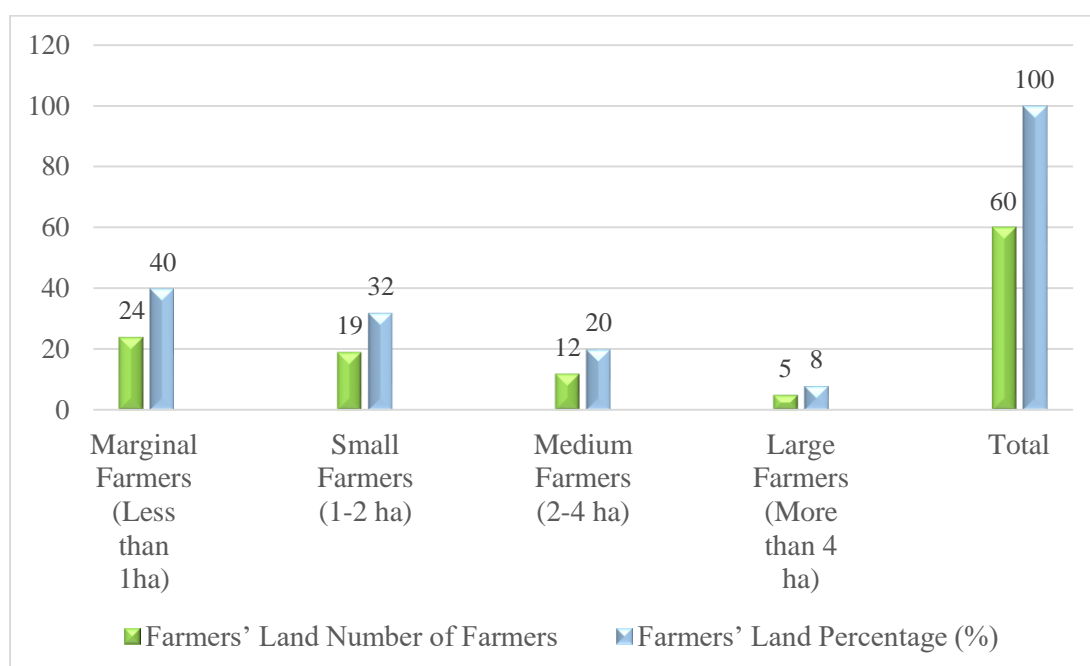


Fig. 5.3: Category wise land holding

5.1.6 Area-wise cultivation of black gram

Table 5.4 and Figure 5.4 represent the area-wise cultivation of black gram. Out of 60 farmers, 93 per cent farmers cultivated black gram in less than 1 hectare area while as 7 per cent cultivated black gram in 1 hectare or more than 1 hectare area. From the perusal of the table, 43 per cent of farmers cultivated black gram in irrigated land, 37 per cent in unirrigated land and 20 per cent farmers in both irrigated and unirrigated land, respectively.

Table 5.4: Area wise cultivation of black gram (n=60)

Parameter	Number of Farmers	Percentage
Less than 1 ha	56	93
1 ha or more	04	07
Total	60	100
Irrigated	26	43
Unirrigated	22	37
Both Irrigated and Unirrigated	12	20
Total	60	100

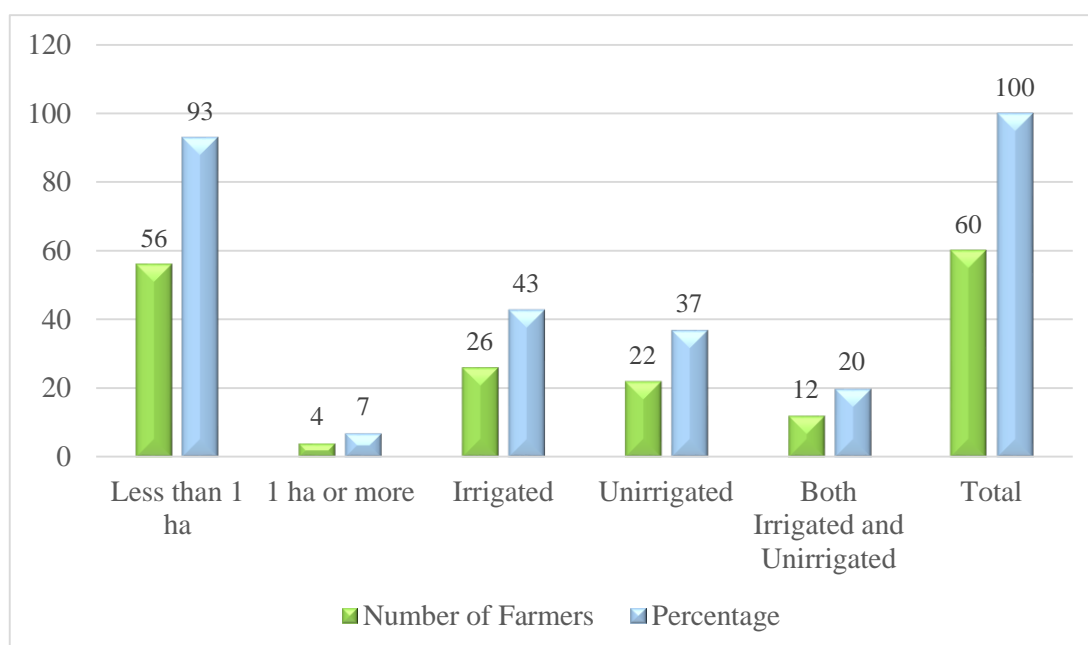


Fig. 5.4: Area wise cultivation of black gram

5.1.7 Area, production and productivity of black gram

Table 5.5 Figure 5.5 represented that the total area under black gram was 17.92 hectares out of which 5.53 hectares area was under irrigation and 12.39 hectares area under non-irrigation. The total production of black gram was 125.64 quintals of which 45.46 quintals production came from the irrigated area and 80.18 quintals production from the unirrigated area. The average productivity of black gram was 7 quintals per hectare from which 8.2 quintals per hectare was from irrigated and 6.4 quintals per hectare from the unirrigated area.

Table 5.5: Area, production and productivity of black gram

(n=60)

Parameter	Area (ha)	Production (q)	Productivity (q/ha)
Irrigated	5.53	45.46	8.2
Unirrigated	12.39	80.18	6.4
Total (Overall)	17.92	125.64	7.0

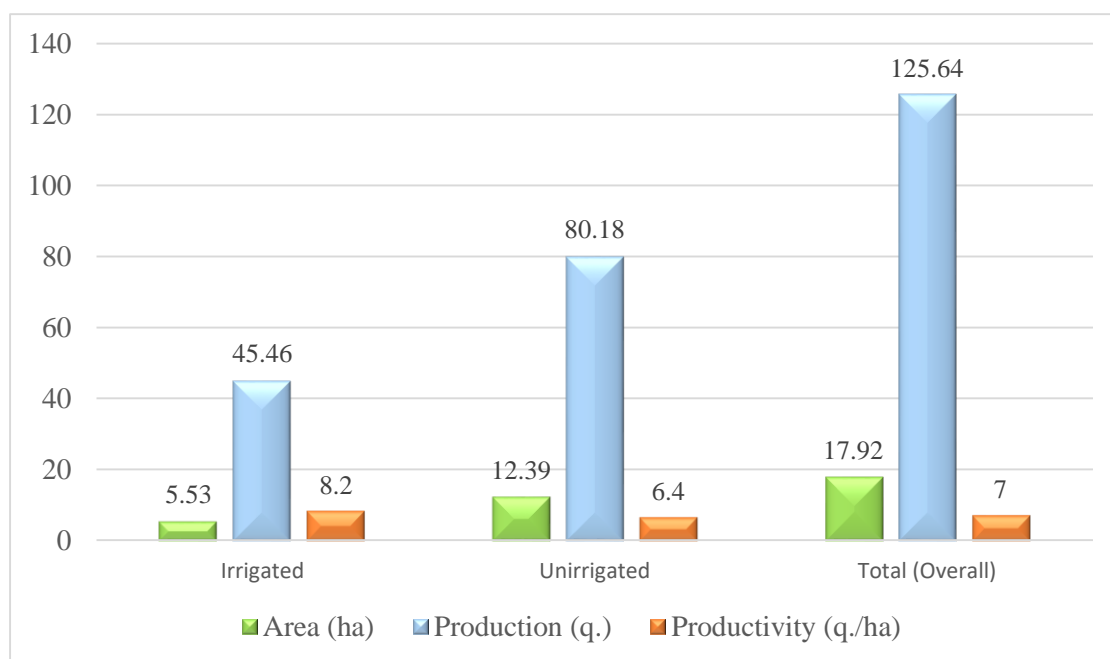


Fig. 5.5: Area, production and productivity of black gram



Plate 1: Interaction with farmers during survey in Akhnoor block



Plate 2: Interaction with farmers during survey in Marh block

5.2 To estimate the market potential of herbicide used in Black gram crop in the study area

5.2.1 Market potential of herbicide in Akhnoor block

Table 5.6 Figure 5.6 showed that the market potential of the herbicides in the black gram crop of Akhnoor block varied from 50.25 litres to 137.50 litres from 2018 to 2022. In 2018 Roundup was sold to the extent of 50.25 litres by the dealers followed by Tagpyr (33.60 l), Agil (28 l) and Whip Super (24.60 l). In the year 2019, total sales of Roundup was 66.25 litres followed by Tagpyr (37.50 l), Agil (34 l) and (28 l) Whip Super. In the year 2020, total sales of Roundup was (73.75 l) followed by Tagpyr (45 l), Agil (37.5 l) and Whip Super (31.50 l). In 2021 total sales of Roundup was 100 litres followed by Tagpyr (57.75 l), Agil (49.50 l) and Whip Super (41.50 l). In the year 2022 total sales of Roundup was 137.50 litres followed by Tagpyr (78 l), Agil (69.50 l) and Whip Super (57.50 l). The compound annual growth rate from 2018-22 was maximum in Roundup (27.44%) followed by Agil (24.53%), Tagpyr (23.57%) and Whip Super (23.26%).

Table 5.6: Market potential of herbicide in Akhnoor block (litres)

(n=10)

Years	ROUND UP	WHIP SUPER	AGIL	TAGPYR
2018	50.25	24.60	28.00	33.60
2019	66.25	28.00	34.00	37.50
2020	73.75	31.50	37.50	45.00
2021	100.00	41.50	49.50	57.75
2022	137.50	57.50	69.50	78.00
CAGR	27.44%	23.26%	24.53%	23.57%



Fig. 5.6: Market potential of herbicide in Akhnoor block

5.2.2 Market potential of herbicide in Marh block

Table 5.7 Figure 5.7 showed that the market potential of herbicides in the black gram crop of the Marh block from 2018 to 2022. In 2018 Hakama was sold 86.25 litres by the dealers followed by Roundup (78.75 l), Iris (76.25 l) and Agil (38.50 l). In year 2019 total selling of Hakama was 87.50 litres followed by Iris (81.25 l), Roundup (80 l) and Agil (30 l). In the year 2020, total sales of Hakama was 106.25 litres followed by Roundup and Iris (103.75 l) and Agil (48.50 l). In the year 2021, the total sales of Hakama was 152.50 litres followed by Roundup (151.25 l), Iris (147.50 l) and Agil (70.50 l). In the year 2022, total sales of Hakama was 225 litres followed by Roundup (222.50 l), Iris (216.25 l) and Agil (99 l). The compound annual growth rate from 2018-22 was maximum in Roundup (31.18%) followed by Iris (30.75%), Agil (28.49%) and Hakama (28.06%). In Marh block instead of Whip Super and Tagpyr, Iris and Hakama were used by the farmers.

Table 5.7: Market potential of herbicide in Marh block (litres)

(n=10)

Years	ROUND UP	IRIS	AGIL	HAKAMA
2018	78.75	76.25	38.50	86.25
2019	80.00	81.25	38.00	87.50
2020	103.75	103.75	48.50	106.25
2021	151.25	147.50	70.50	152.50
2022	222.50	216.25	99.00	225.00
CAGR	31.18%	30.75%	28.49%	28.06%

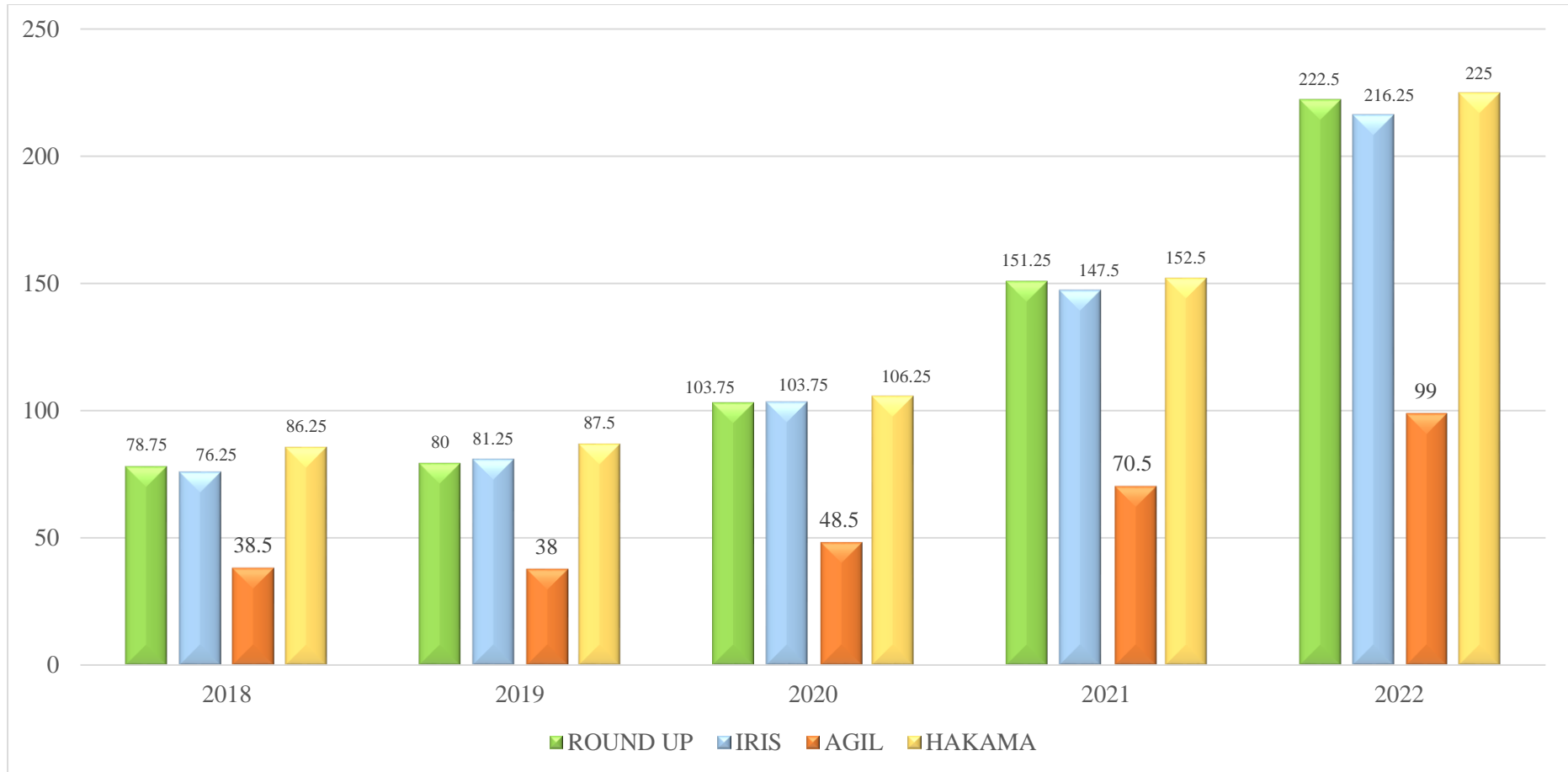


Fig. 5.7: Market potential of herbicide in Marh block

5.2.3 Overall market potential of herbicide in Akhnoor block and Marh block

Table 5.8 Figure 5.8 showed that the market potential of herbicides in black gram crop of the Akhnoor block and Marh block from 2018 to 2022. In 2018 Roundup was sold 129 litres followed by Hakama (86.25 l), Iris (76.25 l), Agil (66.50 l), Tagpyr (33.60 l) and Whip Super (24.60 l) herbicide. In the year 2019, the total sales of Roundup was 146.25 litres followed by Hakama (87.50 l), Iris (81.25 l), Agil (72 l), Tagpyr (37.50 l) and 28 litres of Whip Super. In the year 2020, total sales of Roundup was 177.50 litres followed by Hakama (106.25 l), Iris (103.75 l), Agil (86 l), Tagpyr (45 l) and 31.50 litres of Whip Super. In the year 2021, total sales of Roundup was 251.25 litres followed by Hakama (152.50 l), Iris (147.50 l), Agil (120 l), Tagpyr (57.75 l) and Whip Super (41.50 l). In the year 2022, the total sales of Roundup was 360 litres followed by Hakama (225 l), Iris (216.25 l), Agil (168.50 l), Tagpyr (78 l) and 57.50 litres of Whip Super. The compound annual growth rate from 2018-22 was maximum in Iris (30.75%) followed by Roundup (29.61%), Hakama (28.06%), Agil (26.75%), Tagpyr (23.57%) and 23.26 per cent of Whip Super herbicide. The table depicted that Iris had the maximum market potential while as Whip Super had the minimum market potential though the difference was nearby with each other.

Table 5.8: Overall market potential of herbicide in Akhnoor block and Marh block (litres) (n=20)

Years	ROUND UP	IRIS	HAKAMA	AGIL	TAGPYR	WHIP SUPER
2018	129.00	76.25	86.25	66.50	33.60	24.60
2019	146.25	81.25	87.50	72.00	37.50	28.00
2020	177.50	103.75	106.25	86.00	45.00	31.50
2021	251.25	147.50	152.50	120.00	57.75	41.50
2022	360.00	216.25	225.00	168.50	78.00	57.50
CAGR	29.61%	30.75%	28.06%	26.75%	23.57%	23.26%

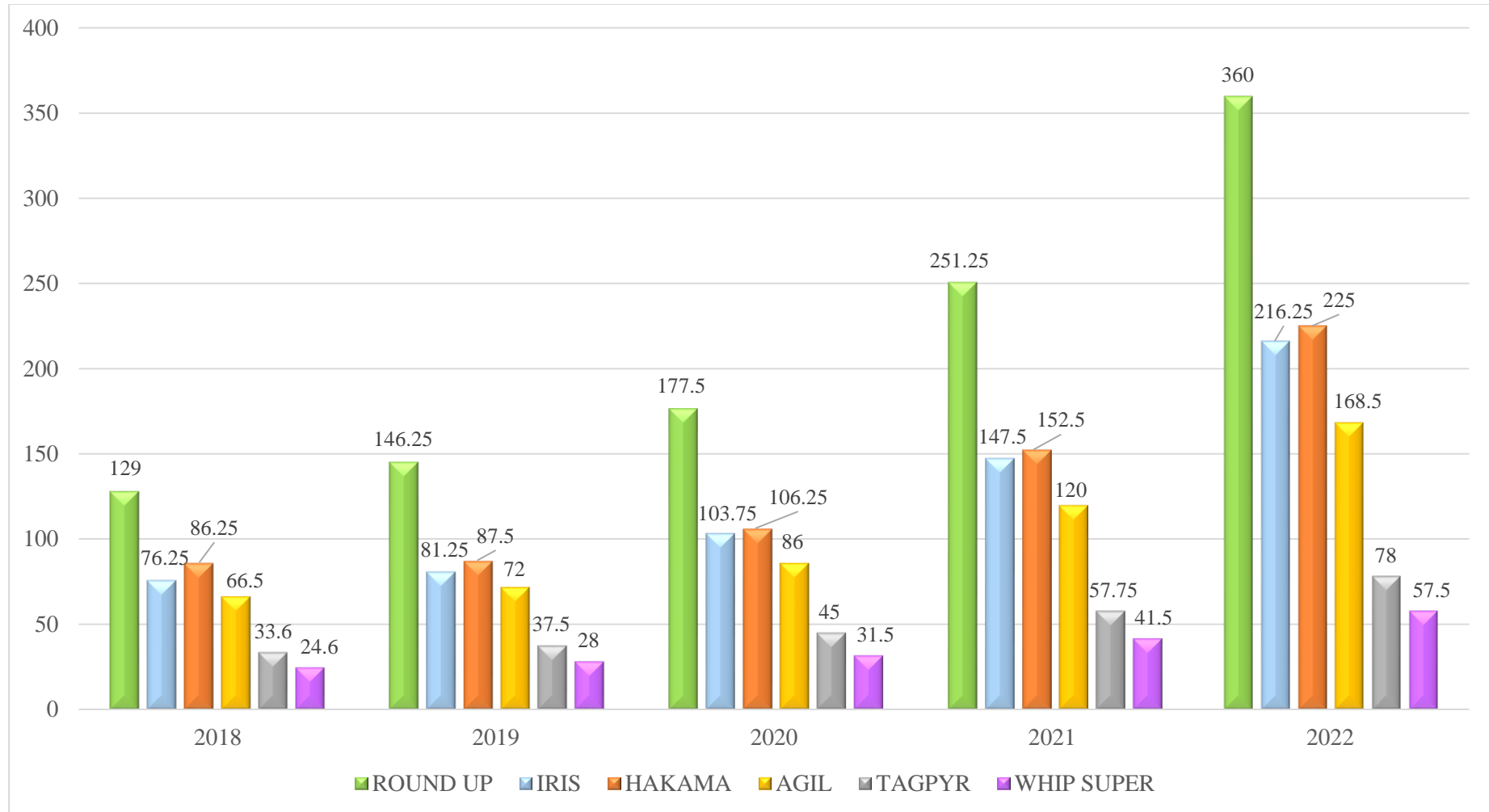


Fig. 5.8: Overall market potential of herbicide in Akhnoor block and Marh block



Plate 3: Interaction with dealer (Mr. Jatin Sharma)



Plate 4: Interaction with dealer (Mr. Kulbir Singh)

5.3 To study the consumption pattern of herbicides under Black gram in the selected area

5.3.1 Consumption pattern of herbicide used by the farmers in black gram

Table 5.9 and Figure 5.9 represented that 51 farmers were using herbicide in their crops which was 85 per cent of the total farmers whereas only 9 farmers were not using herbicide in their crops which was 15 per cent of the total farmers.

Table 5.9: Consumption pattern of herbicide used by the farmers in black gram (n=60)

Parameter	Farmer	Percentage
With herbicides	51	85
Without herbicides	09	15
Overall	60	100

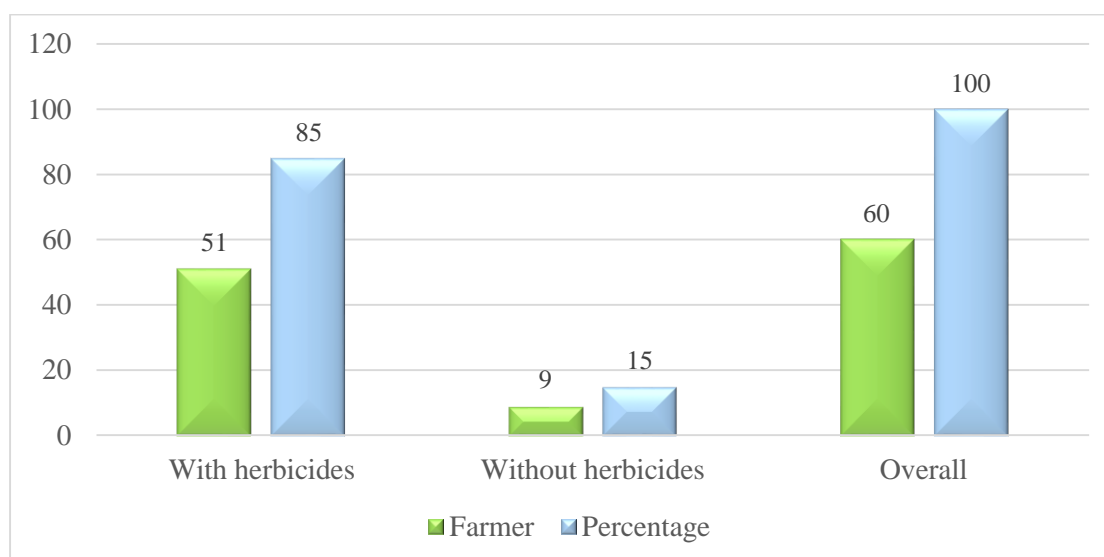


Fig. 5.9: Consumption pattern of herbicide used by the farmers in black gram

5.3.2 Brand wise consumption pattern of pre-emergence herbicide used by the farmers

Table 5.10 and Figure 5.10 showed that out of 51 respondents, pre-emergence herbicide viz., Roundup (Glyphosate) was used by 85 per cent of the farmers whereas 15 per cent of the farmers were using Iris (Pendimethalin) with the brand name Bayer and UPL, respectively.

Table 5.10: Brand wise consumption pattern of pre-emergence herbicide used by the farmers (n=51)

Company Name	Pre-emergence herbicide	Farmer	Percentage
Bayer	Roundup - Glyphosate	32	85
UPL	IRIS-Pendimethalin	19	15
Overall		51	100

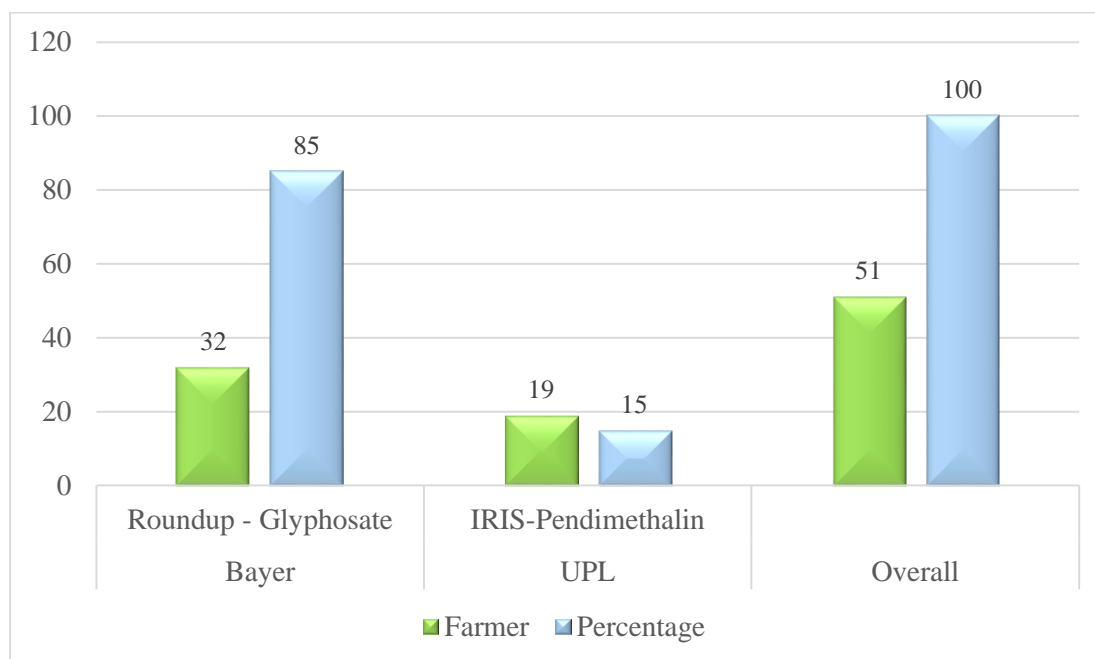


Fig. 5.10: Brand-wise consumption pattern of pre-emergence herbicide used by the farmers

5.3.3 Brand-wise consumption pattern of post-emergence herbicide used by the farmers

Table 5.11 and Figure 5.11 represent the use of post-emergence herbicides. The table depicted the overall picture of two blocks. From the table, it that was clear 51 respondents i.e., 35 per cent of the farmers were using the brand Agil with the company name Adama followed by 20 per cent of the farmers using the brand Tagpyr with the company name Tropical Agro System, 24 per cent of the farmers using brand Hakama with the company name Insecticide India Limited and 14 per cent of the farmers using brand Whip Super with the company name Bayer.

Table 5.11: Brand-wise consumption pattern of post-emergence herbicide used by the farmers (n=51)

Company Name	Herbicide Name	Farmer	Percentage
Tropical Agro System	Tagpyr	14	27
Adama	Agil	18	35
Insecticides India Ltd.	Hakama	12	24
Bayer	Whip Super	07	14
Overall		51	100

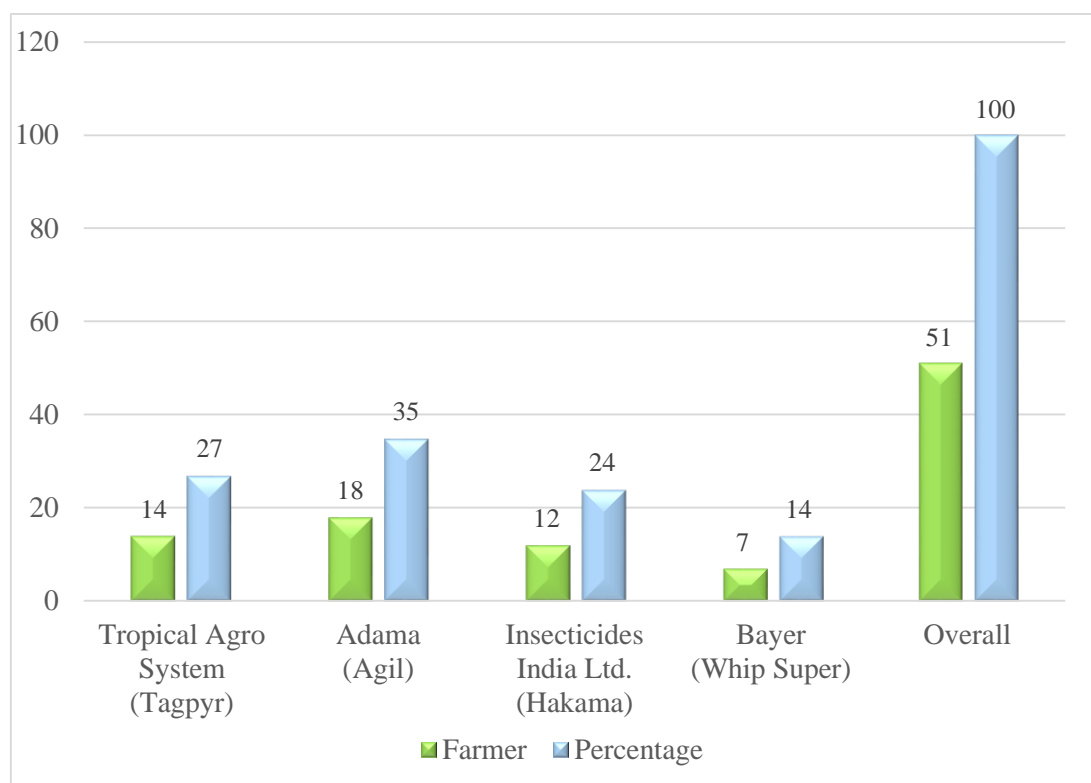


Fig. 5.11: Brand-wise consumption pattern of post-emergence herbicide used by the farmers

5.3.4 Consumption pattern of the quantity of herbicide used by the farmers in litres/ha

Table 5.12 and Figure 5.12 represent the quantity of herbicide used by the farmers. The quantity of Roundup (Glyphosate 41 SL) used by the farmers was 5.12 litres followed by Iris (Pendimethalin 30 EC) 4.20 litres, Tagpyr (Imazethapyr 10 SL) 3.75 litres, Hakama (Quizalofop-ethyl 5 EC) 0.71 litres, Agil (Propaquizafop 10 EC)

0.53 litres and Whip Super (Fenoxaprop-p-ethyl 9.3 EC) 0.45 litres were used by the farmers in black gram.

Table 5.12: Consumption pattern of the quantity of herbicide used by the farmers in litres/ha (n=51)

Herbicide Name	Chemical Name	Quantity (l)
Round up	Glyphosate 41% SL	5.12
Iris	Pendimethalin 30% EC	4.20
Tagpyr	Imazethapyr 10% SL	3.75
Agil	Propaquizafop 10% EC	0.53
Hakama	Quizalofop-Ethyl 5% EC	0.71
Whip Super	Fenoxaprop-p-ethyl 9.3% EC	0.45

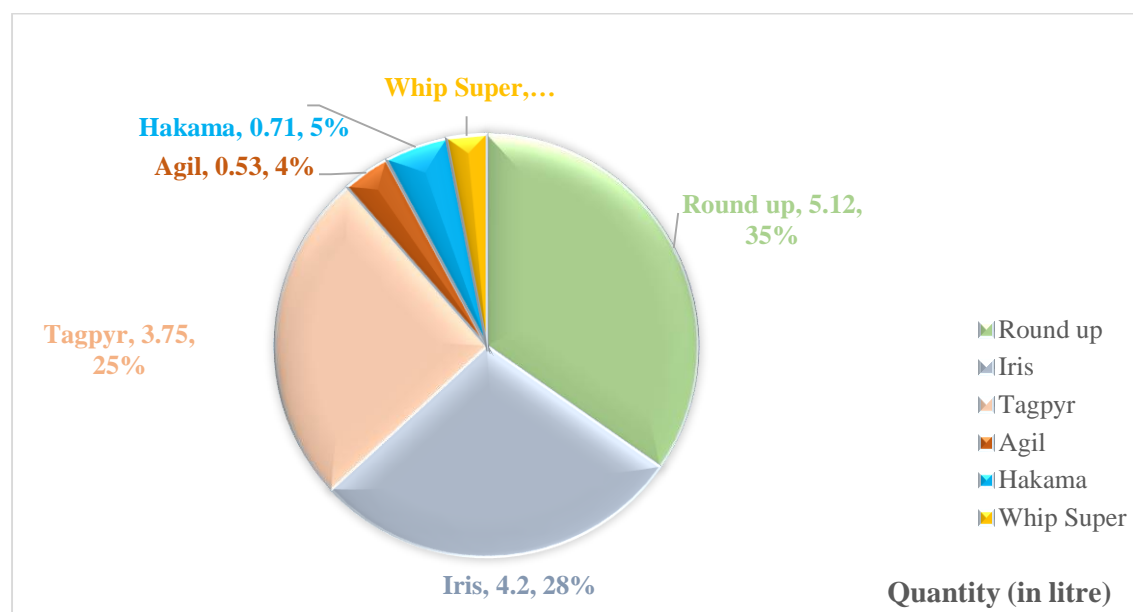


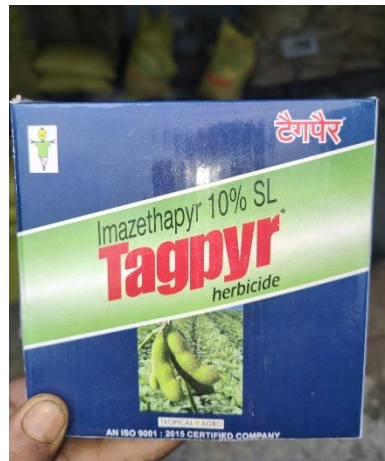
Fig. 5.12: Consumption pattern of the quantity of herbicide used by the farmers in litres per hectare



Roundup



Iris



Tagpyr



Agil



Hakama



Whip Super

Plate 5: Different types herbicides used in black gram

5.4 To study the farmer's preference for herbicides in Black gram

5.4.1 Factor influencing the farmer's preference for herbicides in black gram

Table 5.13 shows that in order to test the adequacy of the sample to conduct factor analysis, it becomes vital to perform the Kaiser-Meyer-Olkin (KMO) test. The particular test signifies the validity of the sample to conduct factor analysis. The value of KMO in Table 5.13 appeared to be 0.761 which should be above 0.50. The value of Bartlett's test of sphericity is statistically significant as the p-value is less than 0.05, so it can be assumed that factor analysis is suitable for the sample collected.

Table 5.13: KMO and Bartlett's Test

(n=51)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.761
Bartlett's Test of Sphericity	Approx. Chi-Square	1329.744
	df	253
	Sig.	0.000

5.4.2 Eigen values and Total Variance Explained

To confirm the validity of the factors incorporated for the analysis the present study has applied for the factor analysis. Table 5.14, revealed that four factors had been extracted after adopting a principal component analysis method. The factors that were formulated and segregated on the basis of total eigen values greater than 1. Table 5.14 shows that factor 1st explains the 48.10 per cent variance to the sample followed by factor 2nd (13.92%), factor 3rd (11.99%) and factor 4th (5.2%), respectively.

Table 5.14: Eigen values and Total Variance Explained**(n=51)**

Total Variance Explained									
Components	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.06	48.10	48.10	11.06	48.10	48.10	5.44	23.65	23.65
2	3.20	13.92	62.02	3.20	13.92	62.02	5.31	23.10	46.75
3	2.76	12.00	74.01	2.76	12.00	74.01	4.27	18.56	65.32
4	1.21	5.28	79.29	1.21	5.28	79.29	3.22	13.98	79.29
5	0.88	3.81	83.11						
6	0.62	2.68	85.79						
7	0.51	2.22	88.00						
8	0.46	2.00	90.00						
9	0.39	1.71	91.71						
10	0.35	1.53	93.24						
11	0.32	1.39	94.63						
12	0.26	1.13	95.76						
13	0.22	0.96	96.72						
14	0.18	0.79	97.51						
15	0.14	0.62	98.13						
16	0.11	0.48	98.61						
17	0.11	0.46	99.08						
18	0.06	0.24	99.32						
19	0.05	0.24	99.55						
20	0.04	0.16	99.71						
21	0.03	0.12	99.83						
22	0.02	0.11	99.94						
23	0.01	0.06	100.00						
Extraction Method: Principal Component Analysis.									

5.4.3 Rotated component matrix

Table 5.15 shows the rotated component matrix extracted four components out of 23 statements which are grouped and named as four factors i.e., constraints, purchasing influence, affordability & quality and awareness. It had 7 iterations and principal component analysis was used, which helped us to interpret complex data in simple form.

Table 5.15: Rotated Component Matrix

(n=51)

Statements	Component			
	1	2	3	4
Constraints encountered while purchasing the herbicides (Exorbitant price)	0.917			
Constraints encountered while purchasing the herbicides (Non availability of herbicides on credits)	0.893			
Constraints encountered while purchasing the herbicides (Spurious herbicides)	0.832			
Constraints encountered while purchasing the herbicides (Unavailability of preferred brand)	0.754			
Constraints encountered while purchasing the herbicides (Lack of detailed knowledge)	0.748			
Constraints encountered while purchasing the herbicides (Accessibility)	0.619			
Influence the purchasing of the herbicides (Dealer advice)		0.769		
Influence the purchasing of the herbicides (Fellow farmers)		0.742		
Influence the purchasing of the herbicides (Brand name)		0.716		
Influence the purchasing of the herbicides (Availability)		0.696		
Influence the Purchasing of the Herbicides (Promotional activities)		0.687		
Influence the purchasing of the herbicides (Company field staff)		0.642		
Influence the purchasing of the herbicides (Progressive farmers)		0.602		
Expectations from standard herbicides (Easy availability)				
Expectations from standard herbicides (Reasonable price)				
Expectations from standard herbicides (Superior quality)			0.906	
Expectations from standard herbicides (Timely available)			0.904	
From which source do you get information about herbicides (Dealers)			0.903	
From which source do you get information about herbicides (Department of agriculture)			0.618	
From which source do you get information about herbicides (Fellow farmers)				
Constraints encountered while purchasing the herbicides (Exorbitant price)				0.955
Constraints encountered while purchasing the herbicides (Non availability of herbicides on credits)				0.941
Constraints encountered while purchasing the herbicides (Spurious herbicides)				0.763
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 7 iterations.				

Constraints

Purchasing influence

Affordability & quality

Awareness

5.4.4 Reasons responsible for purchasing a particular brand

Table 5.16 represented that by using the Garret Ranking Technique and on the basis of weighted mean score, easy availability of herbicides was ranked at 1st position and the other two statements that were ranked 2nd and 3rd position were reasonable price and superior quality of herbicides, respectively. Timely availability of herbicides was ranked at 4th position. Similarly on the basis of weighted mean score accessibility of herbicides was ranked at 5th position.

Table 5.16: Reasons responsible for purchasing particular brand

(n=51)

Expectation from standard herbicides	Average	Rank
Easy availability	40.20	1 st
Reasonable price	35.20	2 nd
Superior quality	33.73	3 rd
Timely available	33.63	4 th
Accessibility	31.86	5 th

5.4.5 Factor influencing the purchasing of herbicides

Table 5.17 represented that by using the Garret Ranking Technique and on the basis of weighted mean score, dealer advice for purchasing herbicides was ranked at 1st position followed by fellow farmers ranked at 2nd position, brand name ranked at 3rd position, availability ranked at 4th position, promotional activities ranked at 5th position, company field staff ranked at 6th position and progressive farmers was ranked at 7th position.

Table 5.17: Factors influencing the purchasing of herbicide

(n=51)

Particulars	Average	Rank
Dealer advice	63.43	1 st
Fellow farmers	63.33	2 nd
Brand name	47.94	3 rd
Availability	37.84	4 th
Promotional activities	37.55	5 th
Company field staff	35.39	6 th
Progressive farmers	33.92	7 th

5.4.6 Source of information about herbicides

Garret Ranking Technique was applied for ranking sources of information about herbicides. The result presented in Table 5.18 revealed that among different sources information from dealers about herbicides ranked 1st while ranks 2nd, 3rd, 4th and 5th were given to the Department of Agriculture, fellow farmers, KVK and company promotional activities, respectively.

Table 5.18: Source of information about herbicides

(n=51)

Particulars	Average	Rank
Dealer	61.57	1 st
Department of Agriculture	46.67	2 nd
Fellow farmers	46.57	3 rd
KVK	38.73	4 th
Company Promotional activities	32.25	5 th

5.4.7 Constraints encountered by the farmer while purchasing the herbicides

With regard to constraints faced by the farmers in purchasing herbicides, the result presented in Table 5.19 showed that on the basis of the weighted mean score of constraints i.e., exorbitant price of herbicides was ranked at 1st position. Non-availability of herbicides on credits and spurious herbicides were ranked at 2nd and 3rd position, respectively. Unavailability of preferred brand was ranked at the 4th position. Similarly, on the basis of the weighted mean score of constraints statements, lack of detailed knowledge of herbicides and accessibility of herbicides were ranked at 5th and 6th position, respectively.

Table 5.19: Constraints encountered by the farmer while purchasing the herbicides

(n=51)

Constraints	Average	Rank
Exorbitant Price	66.57	1 st
Non-availability of herbicides on credits	63.63	2 nd
Spurious herbicides	38.43	3 rd
Unavailability of preferred brand	34.80	4 th
Lack of detailed knowledge	33.33	5 th
Accessibility	27.94	6 th

5.5 Socio-demographic profile of dealers

5.5.1 Age

The data presented in the Table 5.20 and Figure 5.13 revealed that the majority of the dealers, 40 per cent belonged to the age group of 36-45 years followed by 30 per cent of the dealers who belonged to 46-55 years age category, 15 per cent of the dealers belonged to 56 and above years, 10 per cent of the dealers belonged to 26-35 years and only 5 per cent of the dealers belonged to 18-25 years age group.

5.5.2 Education

The data presented in Table 5.20 and Figure 5.13 revealed that the majority (55%) of the dealers had the qualification of a diploma in agriculture followed by 45 per cent of the dealers who had the qualification of graduation in agriculture.

5.5.3 Gender

The data presented in Table 5.20 and Figure 5.13 revealed that a total of 100 per cent of the dealers were male respondents.

Table 5.20: Socio-demographic profile of dealers (n=20)

S. No.	Group	Number of Dealers	Percentage %
1	Age group (in years)		
A	18-25	01	05
B	26-35	02	10
C	36-45	08	40
D	46-55	06	30
E	56 and above	03	15
	Total	20	100
2	Education		
A	Primary School	---	---
B	Middle School	---	---
C	High School	---	---
D	Diploma holder	11	55
E	B.Sc. Agriculture	09	45
	Total	20	100
3	Gender		
A	Male	20	100
B	Female	00	00
	Total	20	100

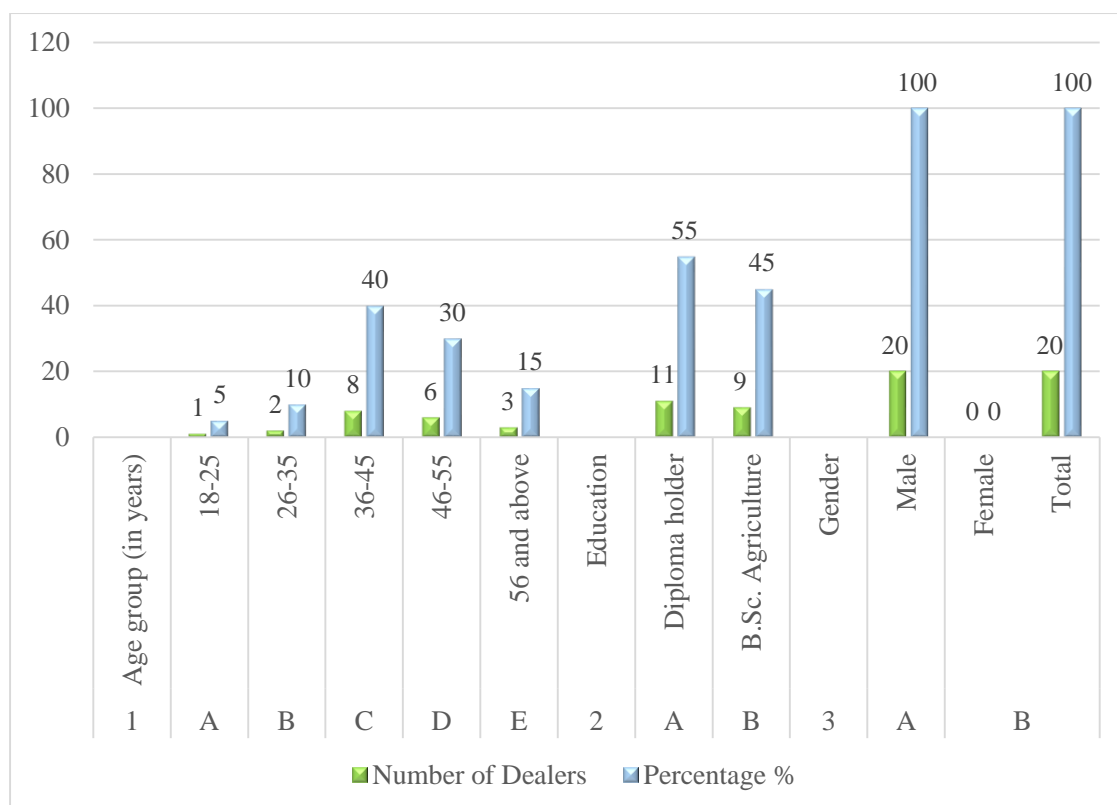


Fig. 5.13: Socio-demographic profile of dealers

5.6 Importance of different parameters by the dealers

With regard to the importance of different parameters by the dealers the result presented in Table 5.21 showed that on the basis of weighted mean score of different factors, high margin of herbicides was ranked at 1st position. Timely supply and good quality of herbicides were ranked at 2nd and 3rd position, respectively. Likewise, high promotional activities, brand images and better services by company people were ranked at 4th, 5th and 6th position, respectively. Similarly, on the basis of the weighted mean score of the importance of different parameters by the dealers, good attractive packaging of products was ranked at 7th position.

Table 5.21: Importance of different parameters by the dealers**(n=20)**

Factors	Average	Rank
High margin	54.25	1 st
Timely supply	49.00	2 nd
Good quality herbicides	46.25	3 rd
High promotional activities	45.25	4 th
Brand image	44.00	5 th
Better service by company people	43.75	6 th
Good attractive packaging	33.00	7 th

5.7 Ranking of promotional activities of herbicides by the dealers

It was analysed by Garret Ranking Technique. The result presented in Table 5.22 revealed that among the different promotional activities, sample distribution of herbicides was ranked at 1st position while 2nd, 3rd, 4th, 5th, 6th and 7th were given to schemes, farmer fair, farmers/dealer's meeting, field day, jeep campaigning and pamphlets, respectively.

Table 5.22: Ranking of promotional activities of herbicides by the dealers**(n=20)**

Factors	Average	Rank
Sample distribution	49.50	1 st
Schemes	49.00	2 nd
Farmers fair	45.50	3 rd
Farmers/dealer meeting	45.25	4 th
Field day	42.00	5 th
Jeep campaigning	40.00	6 th
Pamphlets	33.25	7 th

DISCUSSION

The findings of the present study are discussed in this chapter under the following headings:

- 6.1 Socio-economic profiles of the respondents
- 6.2 Area, production and productivity of black gram
- 6.3 Market potential of herbicide in Akhnoor and Marh Block
- 6.4 Consumption pattern of herbicide used by the farmer in black gram
- 6.5 Factor influencing the farmer's preference in the use of herbicide

6.1 Socio-Economic Profile of the Respondents

6.1.1 Age

The finding of the study with respect to age, out of 60 farmers shows that the majority i.e., 50 percent of the farmers belonged to the above 56-years age group. This highlighted that farming activities were chosen by elderly farmers. The findings are consistent with those of Medhi *et al.* (2020) and Kumar (2022). Whereas in the case of dealers, the study showed that the majority of the dealers i.e., 40 per cent belonged to the middle age group. This showed that dealers of the middle age group were more interested in dealing and doing their business over younger and elder dealers. The findings are in line with the findings of Lalotra (2021).

6.1.2 Education

The findings showed that the majority of the farmers i.e., 37 per cent of the farmers had formal education up to the 'matriculation' level followed by the farmers to have formal education 'primary' level, 18 per cent of the farmers had formal education of middle class, 12 per cent of the farmers had '10+2' and three per cent of the farmers had their formal education up to graduation level. This suggested that the farmers of the sample area had primary to high level of education, perhaps because of their lower education level, farmers might have to work in agriculture. The findings are in consistent with the findings of Nath *et al.* (2017). Whereas in case of dealer's majority i.e., 55 per cent of the farmer had diploma in agriculture followed by 45 per cent of the

farmer had their education in B.Sc. agriculture. This may be because of the requirement for an agriculture license to operate a business selling agricultural inputs that dealers should hold diplomas and degrees in the agriculture.

6.1.3 Farmer's land holding

Farm size and land holding as per Memorandum of Association (MOA 2016) into 4 parts, the study showed that the majority of 40 per cent of farmers belonged to marginal farmers (< 1 ha) followed by 32 per cent of small farmers (1-2 ha), 20 per cent medium farmers (2-4 ha) and eight per cent farmers belonged to large farmers group (> 4 ha). The majority of farmers were marginal farmers. It is in line with the findings of Sulaja *et al.* (2013), Kumar (2022) and Medhi *et al.* (2020).

6.2 Area, production and productivity of black gram

Furthermore, from the analysed result it was found that the majority of the farmers i.e., 93 per cent were growing black gram in less than 1 ha followed by 7 per cent of the farmers growing black gram in 1 ha or more. The reason behind less area for black gram cultivation was due to farmer's priority to grow major cereal crops like rice and wheat. The conformity of the study was with the findings of Kumar (2022). In the case of production, production under irrigated farming of black gram was 45.46 quintals whereas unirrigated area production was 80.18 quintals. The reason behind this might be because the area under the black gram was higher in unirrigated cultivation. In the case of productivity under irrigated cultivation, the productivity of black gram was 8.2 quintals per hectare whereas under unirrigated cultivation the productivity was 6.4 quintals per hectare. The overall production and productivity of black gram was 125.64 quintals and 7.0 quintals per hectare, respectively. The findings were consistent with the findings of Acharya *et al.* (2012) and Anuratha *et al.* (2018).

6.3 Market potential of herbicide in Akhnoor and Marh Block

Akhnoor block

The study showed that the market potential of the herbicides used in black gram was for Agil, Roundup, Tagpyr and Whip Super in the Akhnoor block from the year 2018 to 2022. The overall market potential CAGR of herbicide Roundup was 27.44 per cent followed by Agil with CAGR (24.53%), Tagpyr with CAGR (23.57%) and Whip Super (23.26%) from the year 2018-22.

Marh block

In this study, the market potential of the herbicide used in black gram was for Agil, Hakama, Iris and Roundup in Marh block from the year 2018-2022. Overall market potential CAGR of herbicide Roundup was 31.18 per cent followed by Iris with CAGR (30.75%), Agil (28.49%) and Hakama (28.0%) from the year 2018-22.

The reason behind the maximum market potential of Roundup (Glyphosate 41 SL) in both blocks viz., Akhnoor and Marh is due to its higher chemical soluble liquid percentage and effective impact on weeds.

6.4 Consumption pattern of herbicide used by the farmers in black gram

This study revealed that the majority (85%) of farmers were using herbicide in black gram whereas (15%) of farmers were not using herbicide. The consumption of the pre-emergence herbicide was maximum in glyphosate 41 SL (85%) followed by pendimethalin 30 EC (15%). Whereas in the case of post-emergence herbicides, the majority (35%) of farmers used Propaquizafop 10 EC followed by Imazethapyr 10 SL 27 per cent, Quizalofop-ethyl 5 EC was used 24 per cent and fenoxaprop-p-ethyl 9.3 EC was used by 14 per cent of the farmers. The reason behind the maximum use of Roundup and Agil in the pre-emergence and post-emergence stages of the crop by the farmer might be due to its good impact on weeds and their chemical properties. The findings are in line with the findings of Meshram *et al.* (2016).

6.5 Factor influencing the farmer's preference in use of herbicide

This study revealed that the rotated component matrix extracted four components out of 23 statements which are grooved and named as four factors i.e., constraints, purchasing influence, affordability and quality and awareness, respectively. It had 7 iterations and principal component analysis was used, which helped us to interpret complex data in simple form.

The four factors which are extracted had a reliable variance between them. The first factor showed a 48 per cent of cumulative percentage with a 48 per cent variance. The second factor which was purchasing influence total of 3.2, 62 cumulative percentages and 13.9 per cent variance. The third factor which was affordability and quality showed 2.7 in total with 74 cumulative percentages which showed 12 per cent variance. The fourth factor i.e., awareness showed 1.2 in total and 79 per cent of cumulative percentage with a five per cent variance. This clearly showed that the first-factor had a maximum per cent variance and cumulative percentage. From the above extracted factors constraints show maximum variance and cumulative percentage.

SUMMARY AND CONCLUSIONS

7.1 Summary

7.1.1 Area, production and productivity of black gram

7.1.2 Market potential of herbicide used in Black gram crop in Akhnoor block and Marh block

7.1.3 Consumption pattern of herbicides under Black gram in the selected area

7.1.4 Factor influencing the farmer's preference for herbicides in Black gram

7.2 Conclusions

7.3 Recommendations

7.1 Summary

The project work entitled “**A study on market potential and consumption pattern of herbicides in Black gram of Jammu district**” was carried out in Jammu district of UT J&K during the year 2022-2023. Jammu district had covered the highest area under black gram, so it was taken purposively on the basis of five years highest average area. Akhnoor block & Marh block were selected randomly from the Jammu district. Multi-stage sampling method was applied for the present study and the sample size consisted of 60 farmers and 20 dealers. Four villages were selected from Akhnoor block and Marh block i.e., (Balgara and Payan) & (Chak Kalasey and Gho Manhasan). Data was collected by making an interview schedule and analysed by using statistical tools such as descriptive tables; compound annual growth rate, percentage analysis, factor analysis and Garrett's ranking technique were adopted.

7.1.1 Area, production and productivity of black gram

The area-wise cultivation of black gram. Out of 60 farmers, 93 per cent of farmers cultivated black gram in less than 1 ha area while as 7 per cent cultivated black gram in 1 ha or more than 1 ha area. Out of 60 farmers, 43 per cent of farmers cultivated black gram in irrigated land, 37 per cent in unirrigated land and 20 per cent farmers in both irrigated and unirrigated land, respectively. The total area under black gram was 17.92 hectares out of which 5.53 hectares area was under irrigation and 12.39 hectares

area under non-irrigation. The total production of black gram was 125.64 quintals of which 45.46 quintals production came from the irrigated area and 80.18 quintals production from un-irrigated area. The average productivity of black gram was 7 quintals per hectare from which 8.2 quintals per hectare was from irrigated and 6.4 quintals per hectare from unirrigated areas.

7.1.2 Market potential of herbicide used in Black gram crop in Akhnoor block and Marh block

The market potential of herbicide in black gram crop of Akhnoor block and Marh block from 2018 to 2022. In 2018, Roundup was sold 129 litres followed by Hakama (86.25 l), Iris (76.25 l), Agil (66.50 l), Tagpyr (33.60 l) and 24.60 litres of Whip Super herbicide. In the year 2019, total sales of Roundup were 146.25 litres followed by Hakama (87.50 l), Iris (81.25 l), Agil (72 l), Tagpyr (37.50 l) and Whip Super (28 l). In the year 2020, total sales of Roundup was 177.50 litres followed by Hakama (106.25 l), Iris (103.75 l), Agil (86 l), Tagpyr (45 l) and 31.50 litres of Whip Super. In the year 2021, total sales of Roundup was 251.25 litres followed by Hakama (152.50 l), Iris (147.50 l), Agil (120 l), Tagpyr (57.75 l) and Whip Super (41.50 l). In the year 2022, the total sales of Roundup was 360 litres followed by Hakama (225 l), Iris (216.25 l), Agil (168.50 l), Tagpyr (78 l) and 57.50 litres of Whip Super. The compound annual growth rate from 2018-22 was maximum in Iris (30.75%) followed by Roundup at 29.61 per cent, Hakama (28.06%), Agil (26.75%), Tagpyr (23.57%) and 23.26 per cent of Whip Super herbicide. The study depicted that Iris had the maximum market potential while Whip Super had the minimum market potential though the difference was nearby with each other.

7.1.3 Consumption pattern of herbicides under Black gram in the selected area

The consumption pattern of herbicides showed that 51 farmers were using herbicide in their crops which was 85 per cent of the total farmers whereas only 9 farmers were not using herbicide in their crop which was 15 per cent of the total farmers. Out of 51 respondents, pre-emergence herbicide viz., Roundup (Glyphosate) was used by 85 per cent of the farmers whereas 15 per cent of the farmers were using Iris (Pendimethalin) with the brand name Bayer and UPL, respectively. The overall picture of the two blocks, it was clear that 51 respondents i.e., 35 per cent of the farmers were using the brand Agil with the company name Adama followed by 20 per cent of

the farmers using the brand Tagpyr with the company name Tropical agro system, 24 per cent of the farmers using brand Hakama with the company name Insecticide India Ltd. and 14 per cent of the farmers were using brand Whip Super with the company name Bayer. The quantity of herbicide used by the farmers i.e., the quantity of Roundup (Glyphosate 41 SL) used by the farmers was 5.12 litres followed by Iris (Pendimethalin 30 EC) 4.20 litres, Tagpyr (Imazethapyr 10 SL) 3.75 litres, Hakama (Quizalofop-ethyl 5 EC) 0.71 litres, Agil (Propaquizafop 10 EC) 0.53 litres and Whip Super (fenoxaprop-ethyl 9.3 EC) 0.45 litres were used by the farmers in black gram.

7.1.4 Factor influencing the farmer's preference for herbicides in Black gram

In order to test the adequacy of the sample to conduct factor analysis, it becomes vital to perform the Kaiser-Meyer-Olkin (KMO) test. The particular test signifies the validity of the sample to conduct factor analysis. The value of KMO appeared to be 0.76 which should be above 0.50. The value of Barlett's test of sphericity was statistically significant as the p-value was less than 0.05, so it can be assumed that factor analysis was suitable for the sample collected. It also revealed that four factors had been extracted after adopting a principal component analysis method. The factors are formulated as segregated on the basis of total eigen values greater than 1. Table 5.14 showed that factor 1st explained the 48.10 per cent variance to the sample followed by factor 2nd (13.92%), factor 3rd (11.99%) and factor 4th (5.2%), respectively.

7.2 Conclusions

There were 93 per cent of farmers cultivated black gram in less than 1 ha area while as 7 per cent of farmers cultivated black gram in 1 ha or more than 1 ha area. Out of 60 farmers, 43 per cent of farmers cultivated black gram in irrigated land, 37 per cent in unirrigated land and 20 per cent farmers in both irrigated and unirrigated land, respectively. The total area under black gram was 17.92 hectares out of which 5.53 hectares area was under irrigation and 12.39 ha area under non-irrigation. The total production of black gram was 125.64 quintals of which 45.46 quintals production came from irrigated areas and 80.18 quintals production from un-irrigated areas. The average productivity of black gram was 7 quintals per hectare from which 8.2 quintals per hectare was irrigated and 6.4 quintals per hectare from unirrigated area. In the case of the market potential of the herbicide used in black gram crop in the Akhnoor block and

Marh block from 2018 to 2019, the herbicide brand Iris had maximum market potential with CAGR (30.75%) while Whip Super had the minimum market potential with CAGR (23.26%) though the difference was nearby with each other. From 51 respondent's majority of 85 per cent of farmers were using pre- and post-emerging herbicides in the black gram crop. In pre-emergence herbicide Roundup (Glyphosate) was used by 85 per cent of the farmers. In the case of post-emergence herbicide Agil was used by the majority of 35 per cent of the farmers. The consumption quantity of herbicide was maximum in Roundup (Glyphosate 41 SL) 5.12 litres.

On the basis of the weighted mean score easy availability of herbicides was ranked at 1st position for the reason responsible for purchasing a particular brand. In the case of factors influencing the purchasing of herbicides, on the basis of weighted mean score, dealer advice ranked at 1st position. Information about herbicides from dealers was ranked at 1st position on the basis of weighted mean score by using the Garret Ranking Technique. The exorbitant price of herbicides was ranked at the 1st position considered to be the major constraint encountered by the farmers while purchasing the herbicides. With regard to the different parameters, the dealer's high margin of herbicides was ranked at the 1st position on the basis of the weighted mean score of the different factors. The different promotional activities such as sample distribution of herbicides, farmer fair, farmer's/ dealer's meeting, field day, jeep campaigning, pamphlets and sample distribution have 1st position in doing good promotional activities.

In order to test the adequacy of the sample to conduct factor analysis, it becomes vital to perform the Kaiser-Meyer-Olkin (KMO) test. The particular test signifies the validity of the sample to conduct factor analysis. The value of KMO in Table 5.13 appeared to be 0.76 which should be above 0.50. The value of Barlett's test of sphericity was statistically significant as the p-value was less than 0.05, so it can be assumed that factor analysis was suitable for the sample collected.

7.3 Recommendations

- The company should target village-level dealers as most of the farmers purchase herbicides from village dealers as it is easily accessible and time-saving.
- The company should focus on progressive farmers of their respective villages as this would help the company in making their promotional activities more effective.

- Dealers and farmers, should have proper coordination between themselves.
- The study data showed that Roundup has the maximum market share in the survey area therefore, other brands should implement the same marketing strategies that are employed by Roundup to increase their market penetration and market share.

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2. Which herbicides are you using for Black gram?

Company name	Herbicide name

3. How much area you have occupied under Black gram?

<input type="checkbox"/> 1-5 Kanal	<input type="checkbox"/> 6-10 Kanal
<input type="checkbox"/> 11-15 Kanal	<input type="checkbox"/> 16-20 Kanal
<input type="checkbox"/> 21-25 Kanal	<input type="checkbox"/> 26 Kanal and above

4. How much production you get from Black gram in 1 Kanal of land?

Irrigated land(in quintals)	Unirrigated land(in quintals)	Total (in quintals)

5. What are your expectations from standard herbicides?

Statement	Strongly disagree (SD)	Disagree (D)	Undecided (UD)	Agree (A)	Strongly Agree (SA)
Easy availability					
Reasonable price					
Superior quality					
Timely available					
Accessibility					

6. What are the factors which influence the purchasing of the herbicides?

Statement	Strongly disagree (SD)	Disagree (D)	Undecided (UD)	Agree (A)	Strongly Agree (SA)
Dealer advice					
Fellow farmers					
Promotional activities					
Brand name					
Availability					
Company field staff					
Progressive farmer					

7. What are the constraints you encountered while purchasing the herbicides?

Statement	Strongly disagree (SD)	Disagree (D)	Undecided (UD)	Agree (A)	Strongly Agree (SA)
Exorbitant price					
Unavailability of preferred brand					
Non availability of herbicides on credits					
Lack of detailed knowledge					
Spurious herbicides					
Accessibility					

8. From which source do you get information about herbicides?

Statement	Strongly disagree (SD)	Disagree (D)	Undecided (UD)	Agree (A)	Strongly Agree (SA)
Dealers					
KVK					
Company promotional activities					
Fellow farmers					
Department of agriculture					

5. What is the sale of Black gram herbicides during last year?

Year	Market share													
	Black gram													
	B1	Qty.	B2	Qty.	B3	Qty.	B4	Qty.	B5	Qty.	B6	Qty.	Other	Qty.

6. How do you estimate these parameters according to their importance?

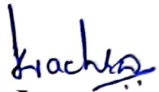
Statement	Strongly disagree (SD)	Disagree (D)	Undecided (UD)	Agree (A)	Strongly Agree (SA)
High margin					
Timely supply					
Good attractive packaging					
High promotional activities					
Good quality herbicides					
Better service by company people					
Brand image					

7. Which promotional activity benefits you most?

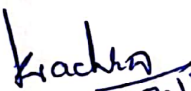
Statement	Strongly disagree (SD)	Disagree (D)	Undecided (UD)	Agree (A)	Strongly Agree (SA)
Jeep campaigning					
Farmers fair					
Field day					
Farmers/dealer meeting					
Schemes					
Pamphlets					
Sample distribution					

CERTIFICATE-IV

Certified that all necessary corrections as suggested by the external examiner and advisory committee have been duly incorporated in the thesis entitled "A study on market potential and consumption pattern of herbicides in Black gram of Jammu district", submitted by Mr. Anshul Thakur, Registration No. J-21-M-85-ABM.


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