

A SWOT analysis of groundnut farm households: Evidence from Mirzapur District in India

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Abstract

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In this study, SWOT analysis has been used to understand the safety precautions, cost-benefit measures, farmers' skill, and few eco-friendly indicators. Generally, socio-economic characteristics of an agriculture farm community illustrate production, investment, educational status, farmers' skill, their lifestyle, and the overall development scenario and prospects. To understand the status of these indicators a cross-sectional study was conducted in the Sikhar block of Mirzapur District, Uttar Pradesh, India. Data was collected through face to face interviews with the help of a pre-structured schedule. This work has found farmers' awareness and application of herbicides are the major strengths in solving existing issues. Weaknesses include lack of latest information, skill in farms households, and inconsistencies in the application of a divergent range and scientific suggestions. Opportunities include alignment with farmers using strategies and existing tools with the application of herbicides as cost-effective and also helpful in reducing irrigation requirements. Threats consider that the application of herbicides to remove unwanted plants is one of the best and more effective but it should be applied in judicial form and farm households should have proper training and scientific recommendations about its application procedure. The present study will help in making strategies for farm households to improving decision-making to solve major issues, but also widely interpreting and communicating to select cost-effective methods. Policymakers should also be careful about weaknesses and it can be minimized by facilitating with proper infrastructure, awareness campaigns, interdisciplinary research, and institutional support to farm households.

Keywords: farm households; herbicides; SWOT analysis; India

JEL Classification: Q-12, Q-15, Q-16, Q-18

Introduction

Technological changes have been major factor in the construction and development of agriculture around the world, especially during last 100 years (Schultz and Ba-

logh, 1964), (Higgins and Green, 1992). While farming crop land has declined from 359 to 320 million acres (between 1920 and 1995) in the United States, and the share of the agricultural labour force has fallen by a large proportion, the agricultural production in 1995 was 3.3 times greater

than that in 1920; owing mainly to the sweeping technological changes in the agricultural sector in all over the world (United States, 1970). Despite the per capita harvested area declining by half, the per person grain production increased by 12 percent, for a world population that doubled between 1950 and 1989 (Boserup, 1975). These figures suggest that productivity has increased and agricultural production methods have changed significantly. Investments in research and development, and agricultural innovations are fundamental to long-term worldwide economic growth, (Mgumia et al., 2015). We can say that proper use of education and innovative skills have various productive values, because it enables the farm households to produce a greater quantity of output from the same amount of inputs; and also, because it enables the farmers to better allocate the available resources. Thus the farm household can make better decisions on matters such as the choice of a more cost-efficient allocation of resources, the choice of the type and the quantity of output to be produced, and the proportion of inputs to be used in the production. Welch (1970) calls these the ‘worker’ and ‘allocative’ effects of education. The former is the “marginal product of education as marginal product is normally defined is the increased output per unit change in education, holding other factor quantities constant”; the latter deals with the manager’s “ability to acquire and decode information about costs and productive characteristics of other inputs”. In the agriculture sector, knowledge and decision-making ability determine how production factors i.e., soil, water, fertilizers and capital can be used. Dissemination of knowledge plays a central role in enabling farmers to take better decisions. Agricultural extension is commonly carried out as a process and system in which information, knowledge and other important skills related to agricultural practices are shared. The need for expansion arises from the fact that there is a direct need to improve the condition of farmers. It is important to initiate education and training of farmers to inform and familiarize them with the rapidly changing technology in the field of agriculture and agricultural innovation and research.

Conceptual Framework and Literature Review

In spite of controversies and challenges, the use of pesticides continues to play an important role in food production; and by providing better protection from pests, pesticides have greatly improved the farming system. The use of water, nutrients and appliances has significantly increased (United Nations, 2012; Ashington, 2012; Weller et al., 2014). The use of herbicides vastly reduces the need for fuel and labourers in the USA (Gianessi & Reigner, 2007a). Figure 1 shows the conceptual framework of the study.

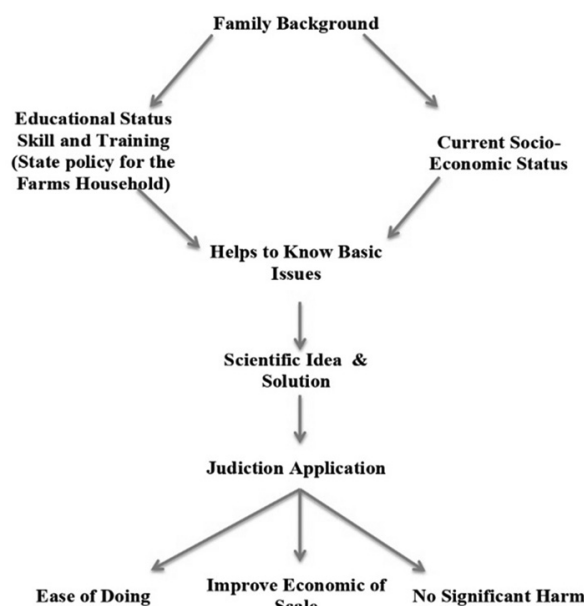


Fig. 1. Conceptual framework of the study

Groundnut is one of the most important cash crops in India but the productivity of groundnut in India is comparatively low (Dukhnytskyi, 2019). There are many problems behind it, where weed control is one of the serious problems due to shortage of manual labour and expensive wage rate. Weed not only reduces the yield, but also interferes with the quality and harvesting of the (Weller et al., 2014; Rashid et al., 2012) during the aman and boro seasons. Three application timings of pretilachlor and five weed control treatments, including (a, (Dhaliwal et al., 2015a; Kausar et al., 2019). Many studies and reports have shown that the rural labour market has undergone profound structural transformation with labour moving from agriculture to non-agriculture activities which has increased labour scarcity and led to high wage rate in India (Gulati et al., 2013). This is a major constraint for the weed management in India. So, shortages of labour and high wage rate have become a major challenge for weed management, especially in groundnut crops.

In modern farming system, herbicide is being used at large scale for weed management especially in developed countries. Intelligent use of herbicides has led to weed management that is more efficient, sustainable and productive than manual weeding. Hand or manual weeding never has been an efficient method of weed control because it takes much time (Moody, 1996; Zhang et al., 2011; Weller et al., 2014; Rashid et al., 2012) during the aman and boro seasons. Three application timings of pretilachlor and five weed con-

ontrol treatments, including (a. Application of herbicides is far cheaper and easily available than labour for manual weeding. Historically developed countries in the past, including United States, Germany, Japan and South Korea, have adopted herbicides for weed management to solve the problem of unwanted plants due to labour scarcity in agriculture sector. Herbicides are the most successful weed control technology ever developed as they are selective, cost effective, fairly easy to apply, have manageable persistence, and offer flexibility in application time. They are eco-friendly if applied in proper dose, method and time, besides being much safer in comparison to other pesticides like insecticides (Canarella & Angeles, 2004). Numerous studies have found that farmers' skill, level of education, farmers' household size, age and experience and other skill development training are the most significant factors in the improvement of crop production (Varasani et al., 2016). A block of Mirzapur District of India was selected for the evaluation of farm households and weed management practices. This block was found in using herbicides to remove unwanted plants in groundnut crops at a large scale. It is important to note that groundnut is a crop in which weed management is important for better production and India faces approximately 40% of total crops loss annually due to lack of proper weed management strategy (Singh, 2013; Sondhia, 2014). India is a relatively underdeveloped country in using modern and innovative technology and chemicals, (Sharma et al., 1995; IFPRI, 2018) and therefore, it becomes important to evaluate the existing scenario with the application of herbicides to control weeds. The primary objective of this study is to evaluate the farmers' skill and attitudes towards application of herbicides for weeds management. Here we have applied SWOT analysis to evaluate the strengths, weaknesses, opportunities and threats of the farmers using herbicides for weed management practices at ground level. SWOT analysis helped to understand the safety precautions, cost-benefit measures, farmers' skill and some eco-friendly indicators of the herbicides.

Research Methodology

A cross sectional study was conducted in the Sikhar block of Mirzapur District, Uttar Pradesh, India. Data were collected through face to face interviews with the help of pre-structured schedule in November, 2018. The schedule was designed in English and translated in Hindi to make it easy for rural farmers to understand. This tool was finalized after appropriate review, discussion with Indian weed scientists and pilot survey. It includes closed ended questions to direct the study in a structured direction. This schedule was generated in multiple-choice format so that respondents

could select only appropriate answers, whichever best described their opinion or attitude on the specific issue. The schedule contained two sections to cover different aspects of the study, followed by basic information on the personal attributes of the farmers including age, gender, education level, years of farming experience, and farming practices; farmers issues related to availability of worker, farmers' skill, pesticide handling practices and the use of personal protective equipment during herbicides application, awareness about application of fertilizers and chemicals in farming and its importance. A macro table was generated with the help of schedule to record data related to input cost and products from the beginning (first week of July) to the harvest (first week of November) of the crop. The population of this work was groundnut farmers. As the climatic condition of the block is mostly the same across the all villages, 11 out of the 57 villages were randomly selected for the primary survey. A household list of groundnut farmers was prepared from all 11 selected villages and finally 205 farmers were interviewed to get accurate information. Farm households were asked a couple of questions like who suggested the use of this chemical, educational status, farming experience, details about self-precaution and a few more questions on herbicides to decode their status. During this work a couple of agriculture scientist were interviewed to know the basic instructions related to the application of chemicals in agriculture crops and those surveyed were asked a few important question to know the actual scenario like application timing, amount of chemicals used, quality of chemicals etc. The results of this survey have been explained with descriptive statistics and figures to make it easy to understand.

SWOT analysis

SWOT analysis is a strategic instrument which helps in identifying the strengths, weaknesses, opportunities and threats related to a particular project or planning faced by a sector, organization, or company (Gao & Peng, 2011). This instrument has its roots in strategic management research, which was conducted in the 1960s and 1970s (Sevкли et al., 2012), and comes from the perspective that the performance of a given economic agent with respect to a particular objective depends upon the way in which the management of that agent interacts with both the internal characteristics of the agent and the broader external context in which the agent must act but over which agents do not have direct control in the short run.. In conducting SWOT analysis of the groundnut farm households in this study, an interactive approach was used. Farmers' socio-economic background, experience, education status, skill and awareness about herbicides, relative costs, availability in the local market, major problems like shortage of labour

and expensive wage rate, precautions, and weaknesses in society like lack of information, crop losses and health and environmental concerns were discussed in different dimensions. In the survey, farmers were asked to share their agreement level, satisfaction level and opinion on five-point scale questions ranging from 1 (strongly disagree) to 5 (strongly agree), there were also a few questions in dichotomous form.

Results and Discussion

Socio-Economic Structure of Farmers

It is important to study socio-economic status to evaluate social and economic indicators that help in understanding the social structure of a society and a particular community. The socioeconomic characteristics used in the study investigated age, marital status, educational level, farming experience, household size, land size etc. The results show that a majority of the farmers (97.56 %) were male and a large proportion belonged to the OBC category (85.85%), followed by SCs (4.39%), and STs (1.95%). It is important to note that around 85 percent of farmers were more than 30 years old, of which, around 44 percent were more than 50 years old. The educational status of the farmers was mainly at the lower secondary level (35.61%) and higher secondary and undergraduate level (42.44%), while 9.76 percent of the farmers were illiterate. The population of the postgraduates in the educational strata of the farmers was relatively insignificant with only 5.85 percent. This shows a moderate condition of the farmers' educational level. As most of the farmers are educated so they are supposed to be skilled in using new technology, fertilizers, following proper recommendations.

In the context of the members of a family of the working-age group, 56.59 percent of the families had only one family member as the bread-earner from agriculture farm (i.e. of working age group of 15-59), and 38.05 percent families had two working members. The families having three members as bread earners were significantly lower (5.37%). In the same contextual framework, 52.2 percent of the respondent strongly agreed to agriculture as their main occupation while 44.88 percent of the respondents agreed to agriculture as their primary occupation. As the figure depicts, agriculture farming was found to be a primary occupation and small family size shows that they would require large proportion of labour in farming. It is noteworthy that a majority of them had marginal or small land holdings and this study did not find any farmers with large land holdings.

Strengths

Amongst the key points identified across all four SWOT categories, the interdisciplinary approach was highlighted as

the most important Strength of Weed Management. (1- 5) scored has been developed of weighted average of farmers' opinion for SWOT and dichotomous opinions were also explained in percentage form). This was followed closely to improve accounting for farmers' opinions and observations on various issues related to agriculture crops, weed management and current scenario and taking a holistic approach. Important issues related to weed-management, existing ground level structure, alternative solutions, farmer's awareness about herbicides for weed management and its importance were raised. The findings of strengths, opportunity and weakness have been ranked and finally it helps to focus on threats. These findings show that the respondents believe that fundamental strengths lie in its interdisciplinary potential and in its ability to support improved decision-making. The farmers' agreement with the strength factor is presented in Figure 2 and Figure 3). The respondent's agreement with the themes presented to strengths ranged above 50% and few variables were scored more than 70% and 90%. In the schedule, 11 questions were traced which could be considered for strengths measurement in SWOT analysis. Six indica-

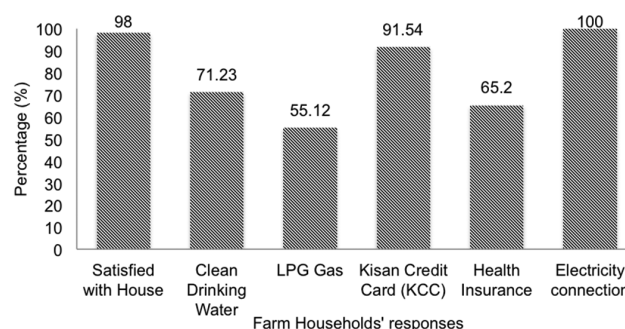


Fig. 2. Strength indicators

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

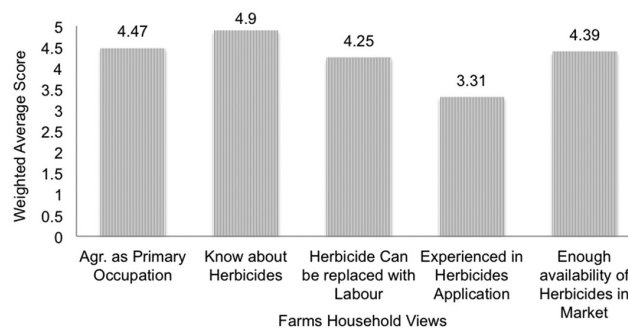


Fig. 3. Strength indicators

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

tors were asked in dichotomous form and average weighted scores were used for the rest of them, which were scored high values (more than 4) score for almost all indicators.

Weaknesses

Sufficient questions were asked to get information on weaknesses in existing system of farm households and agriculture farming, weeds management and farmers' skill and information about farming and a few questions on application of herbicides and its associated concerns. Groundnut farmers agreed that major weaknesses in the existing scenario are incomplete on scientific basis (scored very significant values) and inconsistencies in the application of a divergent range, lack of enough skill followed by training, precaution and scientific suggestions. A few questions were framed to know basic issues like minimum support price (MSP), cold storage facility, and cooperative organization but there was unsatisfactory response on these issues. So, farmers also

considered these monetary issues as major weaknesses. The need to solve the problem of scarce labour and expensive wage was ranked next. It not only creates major economic losses but also creates other supplementary issues like inability to sow seeds on time, loss of market price etc. and these indicators scored high value. Overall, survey respondents highlighted the need to solve issues related to scarce and expensive labour and agree with literature which said that migration, MGNREGA, and government food security schemes could be major causes for scarce and expensive workers (Figure 4 and Figure 5). These variables were found as significant factors to labour scares and its expensiveness (Prabakar et al., 2011; Mohan & Kunnal, 2014; KPMG & FICCI, 2015; Binswanger, 1986). It shows the need for better weed management techniques, like application of herbicides. They agreed to consider herbicides to replace labour, which is relatively cheaper. They fully agreed to use herbicide as an alternative option. Since herbicides are chemicals, so it may

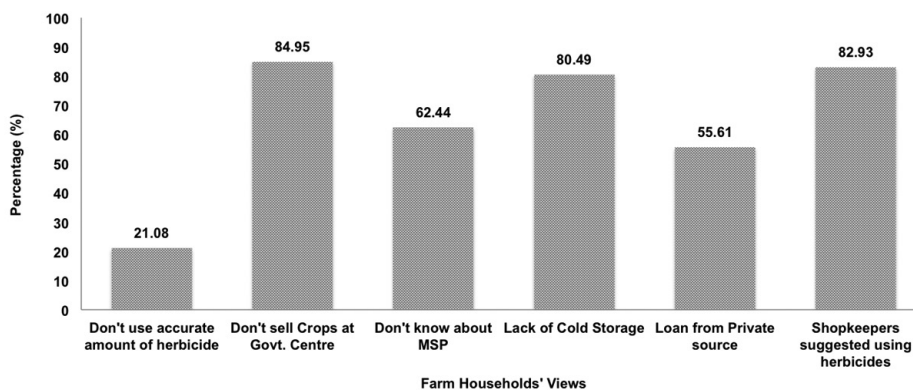


Fig. 4. Weakness indicators

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

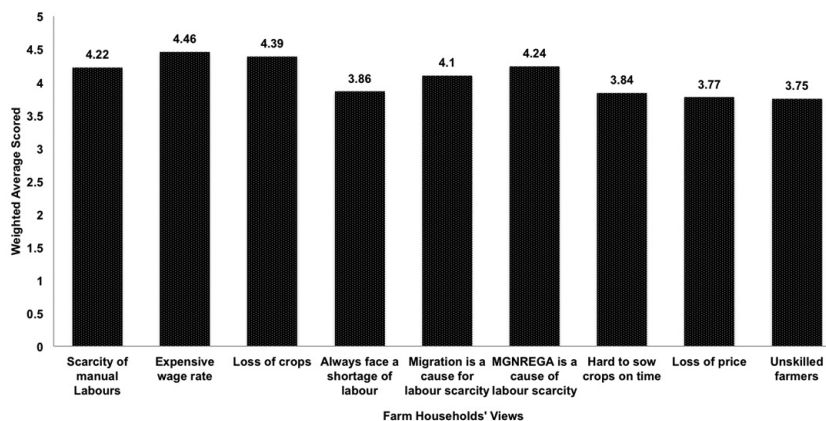


Fig. 5. Weakness indicators

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

have some negative impact if it is not used as proper scientific recommendations and farm household also did not have satisfactory skill, training and self-precaution during application. So, there must be proper training, scientific recommendations and precautionary measure and scientific advice.

Opportunities

Farm households use conventional tools like traditional irrigation system, manual work, especially for weed management. They use manual methods of weed management, which leads to higher cost and time and is also not suitable in some situations (Moody, 1996; Zhang et al., 2011; Godfrey, 2014; Gianessi, 2013 China, Bangladesh; Singh, 2013; Sondhia, 2014). In this category, a list was prepared for themes of opportunities, which reflect the positive outlook of survey respondents for future potential development in agriculture farm production (Figures 6 and 7). Alignment with policies and strategies, and existing tools and alternative method were discussed and ranked as cost effective and eco-friendly opportunity themes. These tools were followed closely by application of herbicides as cost effective and also helpful in reducing irrigation requirement and tillage, and increasing environment and awareness. Herbicides can be recommended for weed management at large scale, which help to solve problem of expensive labour and scarcity. Farm households agreed that application of herbicides would help to reduce water and tillage requirements.

In the study area, around 90% of women were involved in manual methods of weed management at relatively low wage rates and it is assumed to be a negative effect on Indian rural women because of the high work burden. Similar work was also found in some work in Africa (Ogwuikwe et al., 2014; Bergman Lodin et al., 2012; Wekesah et al., 2019). A research work has been done in Africa to overlook the opportunity for herbicides. Herbicide found as a best alternative for solving the problem of unwanted plant in Africa. Over all study of herbicides also released women workers and children from the toil of weeding, preventing chronic pain and spinal deformation while enabling them to pursue their goals such as education and entrepreneurial skill (L. Gianessi & Williams, 2011). It is a form of technological advancement, and demand for ecosystem management can align with application of herbicides with proper strategy.

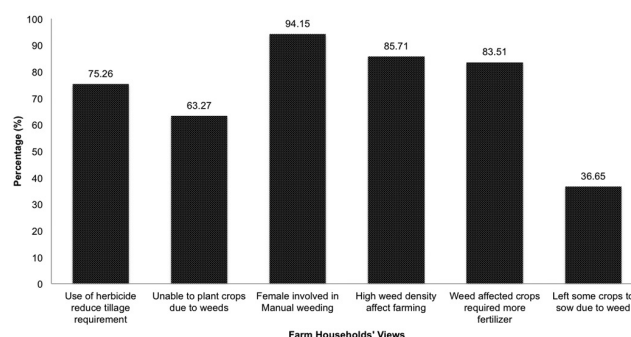


Fig. 7. Opportunities indicators

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

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Threats

Weed management has been a challenge for the agriculture crops production across the countries in all the time. As a result, it was found about 1800 weed species, as a cause of economic losses in agriculture crop production and around 300 of these weeds are responsible for the serious economic losses in cultivated crops production throughout the world (Weller et al., 2014; Gianessi & Ashley, 2014) building on the current infrastructure and existing technology is essen-

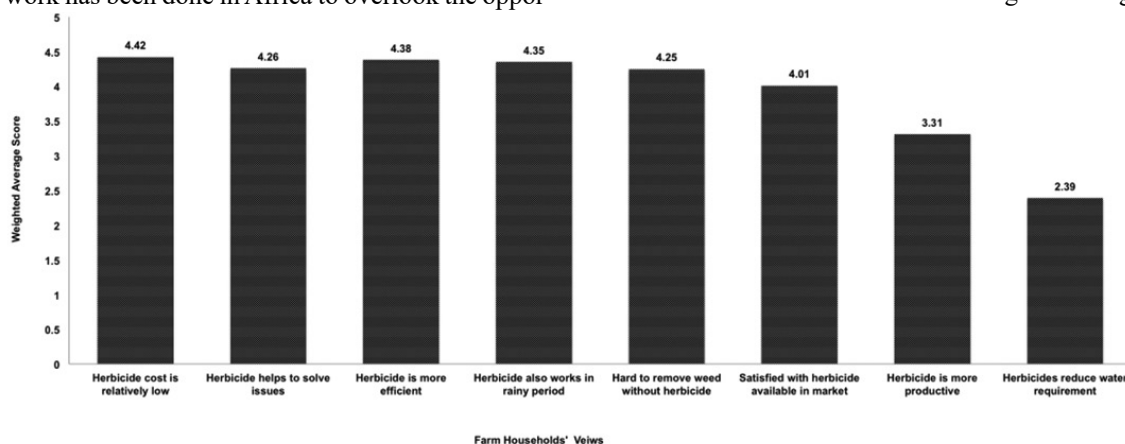


Fig. 6. Opportunities indicators

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

tial. However, at the same time, we must make substantial improvements and/or changes in the feedstocks used, the process technologies applied, and the fuels produced, to achieve true sustainability (see Buchanan and Orbach, Chap. 1; Van Der Zweep & Hance, 2000). Weeds suck essential nutrition at the cost of the crop plants. In this situation, there is competition to get these essential nutrition between crop and weed, during the growing period of crop and weed (Dhaliwal et al., 2015b; Just & Pope, 1979; Just & Pope, 1979). Groundnut needs large numbers of labour for manual weed management practice. Manual weeding method is a primitive method, which is very safe, but it needs high labour force. The chemical weed control method is one of the best and more effective and capable but it should be applied in judicious form and farm households should have proper training and scientific recommendations about its application procedure. The adoption of herbicides could help in India to decrease weed control costs by reducing requirement of expensive labour (Choudhury et al., 2016). But it may have some consequences if not applied scientifically. It may contaminate soil, surface or groundwater, or bioaccumulation in the food chain if a farmer does not use appropriate method in applying herbicides. It may cause adverse effects on environment, the safety and quality of food. Violation of these procedures will create obstacles in different stages. To avoid these, farmers must fulfil the criteria of accurate determination, a chemical measurement, proper sprayer and uniform application.

Farmers' Experience in Chemical Application

In the field survey, farmers' experience in using chemicals for weed control was surprising and it showed a majority of farmers started using it in the last 5 to 10 years. Out of 205 respondents 56.57 per cent use chemical since the last five years while only 1.46 per cent have been using the same for the last 20 years in any part of farming (Figure 8).

It is evident from Figure 8 that only 12.68 percent of the farmers had been vocationally trained to use chemical as a measure to counter weeds. It is important to be careful when applying these chemicals in crops. First of all, the chemicals should be purchased from trusted agrochemical dealers so that farmers get good quality products. They should acquire only the required amount of chemicals if they don't have a safe place to store it. It should not be stored close to the residence and must be kept in original containers. It is important to keep the chemicals at a safe distance from food, children and livestock. Proper precaution must be taken during the handling and preparation of solution, and only clean water should be used (agropedia. iitk.ac.in/2019).

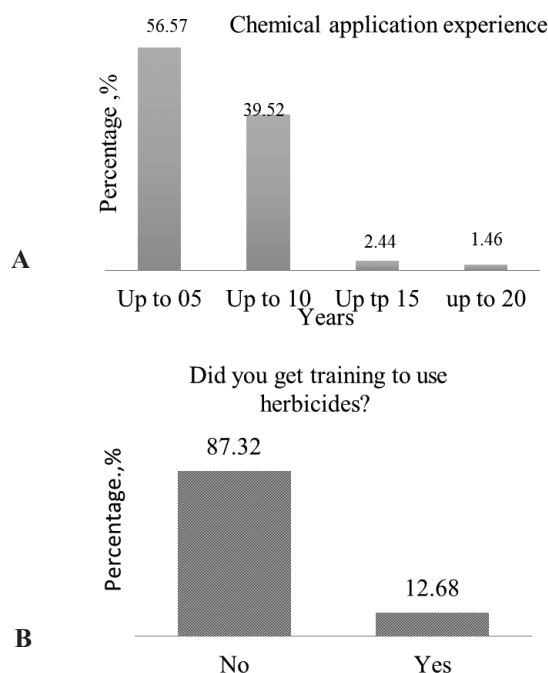


Fig. 8. Weakness indicators – chemical application experience A, Weakness indicators – training to use herbicides B

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

In Sikhar block, 82.93 percent of the farmers revealed that the use of herbicide was suggested by shopkeepers and not by any concrete or reliable source, while a mere 3.41 percent of the farmers revealed that they learnt the use of herbicides from the official source- Kisan Help Line. Farmers also did not know the repercussions of chemicals for human body and the residuals in crops (Figure 9). Farmers were asked a wide range of questions related to their basic knowledge and attitude towards application of herbicides for weed management. The Table 1 summarises the important questions and reflects the seriousness of farmers towards the use of chemicals for weed management. A question was asked to know the farmers' knowledge of the herbicides that can be used for weed management where 97.56 percent of them strongly agreed to know about this chemical, and they responded that herbicides can be used for weed management. The violation of recommended dosage is a matter of grave concern. It was found that often they changed the average dose of recommended herbicides, which can be harmful.

Skin contact is the most widely recognized reason of harm from pesticides, and pesticides promptly enter the body through the skin. At the time of blending, pesticides are increasingly

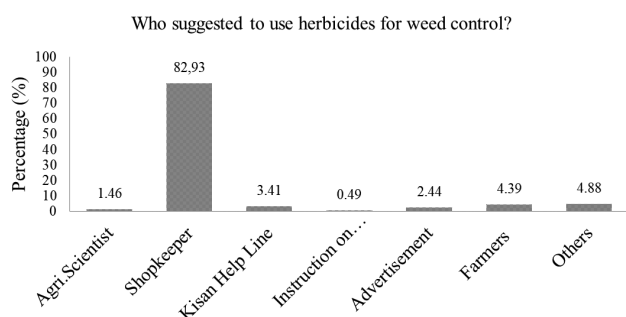


Fig. 9. Weakness indicators – herbicides for weed control

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

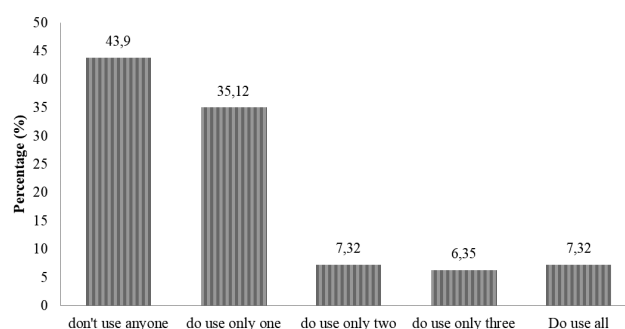


Fig. 10. Use of body cover

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

exposed and the probability of damage maximum during this period. So, it is most important for farmers to be careful during the application of pesticides. All body parts must be covered, especially the head, hand, mouth and feet. Gloves, boots, overalls, hats, goggles, respirator are very important type of protective clothing or equipment required to ensure safety of the operator and it is important to wear the recommended protective clothing. Few more precautions might be included, such as not to smoke, eat or drink while using chemical (<http://npic.orst.edu/health/safeuse.html/May/2020>).

The condition in Sikhar block is not satisfactory; it shows an extremely poor and reckless situation as shown in Figure 10. Only 7.32 percent of farmers cover their all body parts during the application of chemicals, while 35.12 percent of them cover only one part from head, hand, mouth and feet. It is shocking that 43.9 percent of the total respondents do not cover any body part during the application of chemicals. In the current study, most of the groundnut farmers did not have

a sufficient level of knowledge of herbicides used for weed management. Particularly, the farmers were unaware of real herbicides risks while they should have required education and training for safety measurement. Further, the skills of farmers show the influence of having good knowledge in the safe use of herbicides, to avoid intoxication risks. Another study in India has reported similar results on farmers' precautions during the application of such a chemical (Rana and Rana, 2016). Therefore, it is strongly recommended to initiate special educational programs for all farmers before encouraging them for chemical application.

Discussion

The outcomes of the study suggest that key strengths included for the farm household is interdisciplinary, gives the means to improve existing farm households' socio-economic structure. It is a broad-based approach, useful guideline and

Table 1. Respondents' opinion on different questions

Farmers opinions	Strongly Disagree	Disagree	Don't know	Agree	Strongly Agree
Do you know about herbicides?					
	0	2.44	0	0	97.56
Do you use herbicides for weed management?					
	0.98	1.95	2.93	59.02	35.12
Do you use it as per the recommendation given on packet?					
	4.88	18.05	5.37	40	31.71
Is it easily available in your local market?					
	0.49	1.46	0.98	52.68	44.39
Do you change the recommended dosage sometimes?					
	21.08	0	0	0	78.92
Do you use clean water for the application of herbicides?					
	40	30	4.50	5.50	20

Source: Based on primary survey data 2018/ Sikhar block in Mirzapur District, India

tool, which may be used at the macro level, especially in agriculture farm production. Weakness, especially lack of scientific approach in farm households is found a significant and inconsistencies in the application of a divergent range, lack of enough skill followed by training, precaution and various issues linked with scare labour availability. A number of positive outlooks of the survey reflect possible future potential development i.e. opportunities reported by farm households. Alignment with policies and strategies and existing tools and alternative method of weed management with herbicides is cost-effective and eco-friendly by reducing irrigation and less-tillage. It helps to promote conservation agriculture.

Conservation agriculture (CA) defined as minimal soil disturbance (less tillage) and permanent soil cover combined with rotations, is a new agricultural management system, which is being popular in the world. The objective of conservation agriculture is to conserve, enhance and make efficient use of natural resources by integrating the management of soil, available water and biological resources combination with external inputs (FAO, 2018). Use of tractors for weed control requires a large number of fossil fuels that add to the high cost while emission of greenhouse gases which contribute significantly to global warming (Ladha et al., 2003). Farm households strongly agree to consider herbicides as a successful cost-effective weed control method which helps to solve the problem of scarcity of labour and expensive wage rate.

Ample of literature found that balance and judicious application of herbicide is the most successful weed control technology ever developed, as they are selective, non-selective, cost-effective, fairly easy to apply, have persistence that can be managed if applied in judicious form (Moody, 1996; Zhang et al., 2011; Ashington, 2012; Godfrey, 2014; Singh, 2013; Sondhia, 2014). It shows the application of innovative new technology with existing and emerging policies and strategies for the implementation of the approach through existing tools and methods, and the possibility that farm households can normally improve their status. Farmers must fulfil the criteria of accurate determination, a chemical measurement, proper sprayer and uniform application. Finally, identified threats include few risk and demerits. It can be categorized in two categories-first, scarcity of labour and expensive wages are causing a huge loss and will be a big challenge and second, there is lack of skill, proper knowledge and awareness in farm households. Actually these indicators may cause to violate basic criteria of herbicides application. So, there is a need to start a broad skill development program to make people aware. And a lack of institutional support shows the shortage of basic infrastructure and market facility.

Conclusions and Recommendations

The findings of this study is already been supported in different literatures, however, the innovative properties of this work is that such investigation is systematically structured with the help of SWOT analysis. It helps to develop strategies for further analysis of the farm households. It also reflects the views and opinions of farm households, which shape the common framework. This work emphasizes that the farm households cannot have only a way of improving decision making to solves major issues, but also widely interpreting and communicating to select a cost effective methods. Further, it is recommended that the application of herbicides is a way to solve major issues related to expensive wage and scarcity of labour, if it will be implemented more deeply merged with existing policies and incorporating existing tools. Interestingly, this analysis appeals to policymaker to make farm households aware and skilled about in a judicious way to use modern instruments. Experts and specialist should also communicate to farm households about its socio-economic aspects and importance of natural conservation. Policymakers should also be careful about the weakness part and it can be removed by facilitating with proper infrastructure and institutional support to farm households. In other words, through initiatives such as skill development program, enough infrastructure, awareness campaign, etc. may yet to deliver an influential means for facilitating interdisciplinary research, and for better-incorporating sustainability into policy and practice.

Limitations of Study and Scope for Further Work

The sample size in the study was collected from a single block, which is small in absolute terms. It is not enough to represent the scene at the macro level. This work had considered to get information for groundnut only, so there are opportunities to do the experiment for other crops. For further research, it would be interesting to extend the survey more widely to other farm households and evaluate the extent to which the results are in similar with this work. This survey was biased towards the application of herbicides for weed management and compared with manual weed control method that was a major objective of the survey. Therefore, the results may be different if the similar survey approach will be carried out with broad diverse framework including broader socio-economic background, a large number of farm households, farmers' skill and others important indicators and further work could be conducted to draw insights comparison among different groups of farm households.

The strategies, which is mentioned in this study, should be considered as suggestive, rather than a concrete model for implementation.

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