Profile Characteristics of the Farmers Showing Stubble Burning Behaviour in Punjab

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Authors' contributions

This work was carried out in collaboration among all authors. Author AH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors N Bhardwaj and N Basera made the appropriate suggestions and modifications in the manuscript and literature searches. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aim: To study the socio-personal, economic, communication, psychological, and situational characteristics of the farmers.
Study Design: Descriptive design.
Place and Duration of Study: Malwa region of Punjab, between first week of October 2019 to mid-December 2019.
Methodology: Multi-stage sampling was followed. Malwa region was selected purposively because of the maximum number of stubble-burning incidents reported in the area during 2018. Within Malwa region, three districts (Bathinda, Sangrur and Ludhiana) were selected randomly. One block was selected randomly from each district and two villages were selected randomly from each selected block. The sample size of 246 was determined using Cochran's formula and the selection of farmers was based on proportional allocation. Based on the literature, a total of 14 characteristics were taken to document the profile of the farmers who were engaged in the stubble burning behaviour.

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Results: The results indicated that most of the respondents were middle-aged (65.46%), male (91.06%), had formal education up to intermediate level (21.95%) and possessed semi-medium (5-10 acres) landholding (27.24%). Economic characteristics revealed that 51.46% farmers earned low annual income (<Rs. 50,000- Rs.4,50,000), possessed lager milch animals (98.78%) and were practicing specialized farming (45.93%). More than half (51.63%) of the farmers possessed medium information seeking behaviour. Among psychological and situational characteristics, most of the farmers showed medium levels of innovativeness (49.19%), risk orientation (47.15%) and scientific orientation (57.32%) while high levels of ecological consciousness (45.53%) and economic motivation (42.28%). Most of the farmers (45.93%) showed medium level of awareness towards various stubble management measures.
Conclusion: The analysis of these profile characteristics could be crucial in segmenting the farmer respondents and designing target-specific appropriate interventions to tackle the stubble burning behaviour of the farmers.

ABBREVIATIONS

KVK : Krishi Vigyan Kendra
SMS : Subject Matter Specialist
WMS : Weighted Mean Score

1. INTRODUCTION

Rice-wheat cropping system is most prominent in India. The Indo-Gangetic plains in Northern India accounts for around twelve million hectares of rice and wheat crop rotation and harvesting of these crops with combine harvesters is very popular with the farmers. The mechanized harvesting leaves a large quantity of stubble that takes a lot of time to decompose in the soil and is usually burnt for speedy plantation of the next crop. India generates around 600 Mt of stubble which includes about 90-140 Mt of surplus stubble and is likely to be burned in the field [1]. Multipurpose use of stubble includes animal feeding, soil mulching, bio-manure, thatching for rural homes and fuel for domestic and industrial use. Despite knowing of alternative methods of stubble management, farmers burn a significant portion of the crop stubble on-farm so that the succeeding crop can be sown on a cleared field. Mechanized farming coupled with lack of availability of farm labor and high cost associated with the process further exacerbates the problem of stubble burning. In fact, according to a study conducted by International Food Policy Research Institute, air pollution due to stubble burning in northern India causes an estimated economic loss of around USD 30 billion annually, and is a leading cause of acute respiratory infections, especially among children; apart from various ill-effects to environment [2]. In 2019, the System of Air Quality and Weather Forecasting And Research (SAFAR) by the Ministry of Earth Sciences (MoES) reported that the share of stubble burning in air pollution in Delhi-NCR rose to about 46 per cent and thus, public health emergency was declared in the region.

The governments at different levels have attempted to restrict the stubble burning through numerous measures and campaigns designed to promote sustainable management methods. India's National Green Tribunal banned stubble burning in 2015 but it had little or no effect in northern states. The charging of monetary penalties from the farmers who burn the stubble and FIRs against them has only politicized the issue rather than putting a brake on it. In spite of the provision of the subsidies for mechanized measures, they are also not reaching the farmers due to bureaucracy and other factors. In 2019, the paddy season overlapped with the 550th '*Parkash Parv*' of the first Sikh Guru, Shri Guru Nanak Dev Ji. The Punjab Government chose to make his holy verse '*Pavan Guru, Pani Pita, Mata Dharat Mahat*' (air is guru, water the father, earth the eminent mother) as the focus of its campaign against stubble burning before the paddy harvesting season began. It was hoped that Guru's eternally-relevant incitement on environment would resonate with farmers more than ever before but the number of stubble burning incidents were more than ever which indicates that just tapping the emotional appeal of the farmers was also not enough.

However, it would be interesting to see the latest direction of the apex court to the Punjab government to provide incentives at the rate of Rs. 100 per quintal to the farmers who do not burn the stubble in the upcoming seasons. As of today, despite enormous efforts and measures, the desirable results to bring change in farmers'

behaviour to stop stubble burning is still awaited. It seems that the problem of stubble burning is difficult to be solved by technical or legal interventions alone. Research studies have shown that simply trying to tell people to change, or giving them information and expecting them to act on it, may not work if the determinants of certain behaviors are not considered. There is a need to sensitize the farming community by using interventions which can enable farmers to rethink and change their behaviour and have a new perspective in this regard. In order to understand and change behaviour, scientists rely heavily on appropriate behavioural theories to identify determinants of a particular behaviour. To understand the behaviours, the first step is to understand what all characteristics do the farmers possess. A knowledge of these characteristics, coupled with other behavioural determinants will help in proper segmentation of the target audience farmers and tailor suitable strategies to tackle their stubble burning behaviour. Hence, this study made an attempt to identify the socio-personal, economic, communication, psychological and situational characteristics of the farmers who are engaged in stubble burning behaviour in Punjab state.

Roy [3] reported in a comparative study on paddy straw management in Punjab and West Bengal that in case of Punjab, half of the farmers belonged to 21-36 years of age and maximum number of farmers (36.67%) were educated up to senior secondary level. It was also revealed that a little less than half of the farmers (48.33%) had a medium *i.e.* 10-25 acres of land holding while only 5 per cent of the farmers had large (>25 acres) operational land holdings. It was reported that 60 per cent of the farmers in Punjab belonged to the low-income group and half of the farmers had medium level of extension contacts. It was found that farmer-extension linkage was not very strong and farmers' visit to the various agricultural organizations such as State Agricultural Universities (SAU) and Krishi Vigyan Kendra (KVKs) were not very frequent. It was reported that more than 56 per cent of the farmers had a medium level of innovativeness, half of the farmers had a low risk orientation while 63.33 per cent of the farmers had a high level of ecological consciousness. Singh et al. [4] in their study in Punjab found that majority of the respondents were falling in age group of 31-40 years (56.7 and 60% respectively). It was also reported that most of the respondents (40 and 53.3%) were having education qualification upto matriculation in both the categories. Deepika [5]

reported in a study in Punjab that majority of respondents belonged to old age category, were matric passed, possessed medium-sized land holding and had low annual income. It was also reported that the majority of the farmer respondents possessed medium mass media exposure, extension participation and had poor research and extension linkages. Sharma et al. [6] in a study found that majority of the respondents (62.50%) in Punjab belonged to middle age group and all respondents were educated with majority (54.17%) of them had passed Intermediate. The farmers predominantly had nuclear family (73.33%) and majority of them (71.67%) possessed 4 to 10 ha of land holding and their annual income ranged between Rs. 2.5 lacs to Rs. 6 lakh (65%). Majority of the farmers (65%) had high to medium level of extension contacts, risk taking capacity (55%) and innovativeness (58.33%).

2. METHODOLOGY

2.1 Research Design

For the present study, descriptive design was used which includes surveys and fact-finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs as it exists at present and also shows cause and effect relation between non-manipulated variables.

2.2 Sampling Procedure

Sampling is the statistical process of selecting a part of population, also known as a "sample" for the purpose of making observations and statistical inferences about that population. The multi-stage sampling procedure adopted for the present study is as follows. According to Kumar et al [7], the majority of the stubble burning incidents in North India were recorded in Punjab alone. While in Punjab, the Malwa region accounted for almost 95 per cent of the total crop stubble burning incidents. Therefore, the Malwa region was selected purposively as the locale for the study. From Malwa region, three districts namely Bathinda, Sangrur and Ludhiana were randomly selected. One block from each selected district were selected through Simple Random Sampling without replacement. Out of nine blocks of Bathinda district, Bathinda block was selected; while out of thirteen blocks of Ludhiana district, Khanna block was selected by simple random sampling method. Similarly, out of ten blocks of Sangrur district, Sunam block was

selected randomly. Thus, a total of three blocks from three districts of Malwa region were selected for the study. The selected blocks are the major growers of rice and wheat. This also indicates that the farmers in the selected blocks follow rice-wheat cropping pattern. The selection thus meets the the basic requirement of the study.

After the selection of blocks, a list of villages was prepared for each block. The total number of villages across the selected blocks was found to be 143. Out of which, 29 villages belonged to Bathinda block of Bathinda district, 73 villages to Khanna block from Ludhiana district and rest 41 villages were from Sunam block of Sangrur district. These villages constituted the sampling frame for the study. Further, two villages from each block were selected through Simple Random Sampling without replacement. As a result, villages named Khialiwala and Amargarh from Bathinda block; Goh and Lalheri from Khanna block; and Lakhmirwala and Kharial villages from Sunam block were selected randomly for the study.

The basic criteria for selection of farmers as the respondents for the study was that the farmer must have been following the rice-wheat cropping pattern for at least past five years. There are different formulae for determination of appropriate sample size when different sampling techniques are used. For selecting farmers from the villages, appropriate sample size was estimated by using Cochran's formula, which is given below:

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where,

$n_{0=}$ sample size
Z= selected critical value of desired confidence level

p= estimated proportion of an attribute that is present in the population and q= (1-p)
e= desired level of precision

Assuming the variability to 20 per cent (i.e. q=0.2) and taking 95% confidence level with ±5 per cent precision, the required sample size was calculated as follows:

As, q = 0.2
p =1-0.2 = 0.8
e = 0.05
z =1.96

$$n_0 = \frac{(1.96)^2(0.8)(0.2)}{(0.05)^2} = 245.86 = 246 (\text{approx.})$$

Therefore, 246 farmers were selected as respondents through proportional allocation for the fulfilment of pre-determined objectives. Table 1 describes the selection of the respondents according to the farmer population in the villages. The data in Table 1 shows that the maximum number of respondents was selected from Khialiwala village (67) of Bathinda block, followed by Kharial village (56) of Sunam block and Goh village (40) of Khanna block. The number of respondents selected from village Amargarh from Bathinda block were 36 while, 26 and 21 respondents were selected from villages Lakmirwala of Sunam block and Lalheri from Khanna block respectively.

2.3 Selection of Variables

The focus of the study was to study the stubble burning behaviour of the farmers and factors which could possibly be responsible for the same. Thus, the profile variables of the farmers for the present study were selected on the basis of extensive review of literature related to the farmers and stubble burning, after thorough consultation with experts. The variables which accounted to have most relevance to the practice

Table 1. Selection of the respondents

S. No.	Blocks	Selected villages	Total population	Farmers population	Respondents for study
1.	Bathinda	Khialiwala	3091	447	67
		Amargarh	1151	235	36
2.	Khanna	Goh	2879	268	40
		Lalheri	2278	141	21
3.	Sunam	Lakhmirwala	1719	171	26
		Kharial	2882	370	56
	Total		14000	1632	246

of stubble burning were finally selected and included in the study. The socio-personal, economic, communication, psychological and situational characteristics of the farmers were taken for the study. These included farmers' age, gender, education, size of land holding, annual income, livestock possession, type of farming, information seeking behaviour, innovativeness, risk preference, scientific orientation, ecological consciousness, economic motivation and awareness about stubble burning measures.

2.4 Statistical Tools and Techniques Used

Appropriate statistical tools such as frequency, percentage, mean, standard deviation and weighted mean score were used to analyse the data. The final categories were made on the basis of cumulative cube root method.

3. RESULTS AND DISCUSSION

3.1 Age

Age can play a prominent role in determining the level of social and economic participation of an individual in a social system, with respect to experience and responsibility. The data regarding age composition of respondents has been presented in Table 2. It reveals that majority of the respondents (65.46%) residing in the sampled villages belonged to the middle age category (26 to 50 years). There were only 19.10 per cent farmer respondents who fell under the old age category (>50 years) followed by 15.44 per cent of the farmers who were in the young-age category (<26 years) respectively.

The reason behind this might be the growing reluctance of farm families to indulge the upcoming generations in agriculture as a traditional or family profession due to decreasing profits in the venture. On the other hand, the majority of people from young age-group were also not found to be much interested in continuing agriculture or taking up other allied venture as a form of business. Instead, they were keenly interested in going abroad particularly Canada, Australia, New Zealand and United Kingdom and settling down there. The parents are willing to send their children abroad even if they have to take up some kind of loan. As a consequence, most of the respondents belonging to middle and old age groups happen to be the farmers who are left behind. So, the lack of interest among majority of the younger

generations in taking up agriculture as an occupation, might have contributed to the higher percentage of farmers in middle aged category in the sampled villages. Studies like Anand [8], Singh et al [4], Sharma et al [6] and Lyngdoh [9] also revealed that most of the farmers in Punjab were found in the middle-aged category.

3.2 Gender

The gender distribution of the respondents is presented below in Table 2. It is evident that majority of the respondents were men (91.06%) and only 8.94 per cent of the total farmer respondents were women. This situation is due to the fact that in the study area, most of the agricultural activities are carried out by men and women were primarily engaged in household and other activities. Most of the women respondents took up farming as their primary occupation under unfortunate family situations such as passing away of the male head of the family. Although, there were a few women farmer respondents who took up farming by their own choice after pursuing higher studies in agriculture. They were willing to apply the learning of their academics to practical fields. Studies including Indimuli [10], Imarhiagbe [11] and Joshi [12] also found that majority of farmer respondents were men in their respective investigations.

3.3 Education

The educational status of respondents has been presented in Table 2. It shows that maximum respondents (21.95%) had education up to Intermediate level followed by 21.54 per cent respondents belonged to graduate level of education. Among all the respondents, 19.10 per cent had formal education up to high school level. Around 13 per cent of the farmer respondents had received formal primary education while 12.20 per cent farmers were found to be functionally literate. Only 5.29 per cent of the farmer respondents were Post Graduates while 6.91 per cent farmers were categorized as illiterates. The data further indicates that a considerable proportion of farmer respondents (19.11%) were found to be either illiterate or functionally literate. These respondents majorly belonged to the old-age group who basically lacked enthusiasm, need and resources to access formal education at their times. On the other hand, more than half (54.06%) of the total farmer respondents couldn't or didn't continue their formal education beyond

school level. These include respondents who formally studied up to primary level, high school level and intermediate level. It was also noted that majority of these respondents belonged to middle-age group who had a limited access to resources and had identified education as a basic need to some extent. The results further revealed that more than a quarter (26.83%) of the farmer respondents had pursued higher education, i.e. Graduation and Post-Graduation.

Similar results were noted in the studies of Parganiha and Sharma [13], Palvi et al. [14] and Saklani [15] in which the maximum number of farmer respondents had intermediate or higher/senior secondary level of formal education.

3.4 Size of Land Holding

The distribution of farmer respondents on the basis of their size of land holding is depicted through Table 2. It is evident from data that the maximum number of respondents (27.24%) possessed semi-medium size, i.e. 5-10 acres of landholding. Farmers with small-sized landholding (2.5-5 acres) accounted for 21.95 per cent, which were followed by the farmers possessing medium sized land (19.51%), i.e. 10-25 acres. The marginal size of land holding (less than 2.5 acres) was held by 18.70 per cent of the farmer respondents, while 12.60 per cent of the farmers owned large size landholdings, i.e. more than 25 acres. The above findings are found to be in line with those of Mohapatra [16], Anand [8], Lyngdoh [9] and Singh et al. [17] which reported that the highest number of farmer respondents had semi-medium (5-10 acres) or medium sized (10-25 acres) land holdings.

3.5 Annual Income

The data regarding annual income is presented below in Table 2 which clearly indicates that the majority of the farmers (51.63%) were categorized under 'low' annual income (<Rs.50,000- Rs.4,50,000) category. The farmer respondents who were classified under 'medium' annual income category (Rs. 4,50,000-Rs.8,50,000) accounted for 29.67 per cent. On the other hand, only 18.70 per cent of the respondents were classified under 'high' annual income category who earned between Rs. 8,50,000 to 12,50,000 per annum.

During the investigation, it was found that most of the farmer respondents were dependent on agriculture as their sole medium of income. With the increasing cost of cultivation and decreasing returns year by year, the farmers are bound to have less income. Some of the small and marginal farmers even expressed their concern for agriculture in the upcoming future because it is becoming hard for them to sustain and meet the expenses with the income they are earning from the limited resources. Since, around two-third of the farmer respondents possessed marginal, small and semi-medium sized land holdings and due to lack of other secondary occupations, most of the farmers earned less and were categorized under 'low' annual income category. On the other hand, most of the farmers who hold medium and large sized land holdings were able to earn comparatively more than the famers belonging to marginal, small and semi-medium sized land holdings. Some of them even had secondary sources of income like small businesses like *kirana* shops, confectionary shops, general stores, etc. in the villages and nearby towns which helped them manage their expenses. Hence, they were classified under 'medium' annual income category. The farmer respondents who belonged to 'high' income category were mostly large-sized land holders having other side businesses as well like dairy and poultry farms, *aadats* in *mandis*, tractor dealerships, cloth and car showrooms, seed plants and warehouses, etc.

The findings of the studies done in Punjab including Roy [3] and Deepika [5] were found to be in line with the present study as they also reported that the majority of farmers belonged to 'low' income categories. Contradictorily, other studies done in Punjab like Sharma et al. [6] and Lyngdoh [9] reported that majority of farmers belonged to 'medium' income group.

3.6 Livestock Possession

The Table 2 clearly reveals that a majority of the respondents (98.78%) possessed larger milch animals including buffaloes and cows, especially buffaloes. On the other hand, poultry animals were kept by 8.1 per cent of the respondents while 4.47 per cent of the total respondents possessed draught animals like oxen. The findings also show that smaller milch animals like sheep or goat were reared by just 3.66 percent of the farm respondents.

During the investigation, it was noted that almost all the farm families had at least one milch animal especially buffalo because the people in villages

preferred consuming buffalo milk over any other type of milk. Several households possessed cows as well. Some of the farmers, who had excess production of milk, sold it in nearby towns also. Some of the farmer respondents had poultry farms as a subsidiary venture and thus, kept poultry birds. Only a few households had kept goat because the majority of the people had larger milch animals for milk. The goat milk was especially consumed as a medical remedy for various diseases and thus, fetched good price. People from nearby towns also used to come and get it in case of emergency. Although, mechanization has taken over the manual or animal drawn operations in agriculture in most of the Punjab, some farmers had still kept oxen. Occasionally, farmers earned well from the semen of oxen which was used in artificial insemination of cattle.

Similar findings were reported in the studies of Karuna [18], Basera [19] in Uttarakhand and Dash [20] in Odisha, who also found that majority of the respondents possessed larger milch animals.

3.7 Type of Farming

The findings regarding livestock possession of the farmer respondents has been presented in Table 2. It is clear from the data that maximum number of the respondents (45.93%) practiced specialized farming. On the other hand, mixed and diversified types of farming were found to be practiced by 28.46 per cent and 25.61 per cent of the farmer respondents.

The major chunk of the farmer respondents was practicing specialized farming. It can be explained by the fact that most of the farmers were dependent solely on agriculture as a means of income; hence they grew crops on a commercial level and sold their crops in the nearby *mandis.* Such farmers had basically one motive only, i.e. to have the utmost production and yields and ultimately, maximized profits. For that purpose, they used all kinds of inputs such as chemical fertilizers, insecticides, pesticides, growth enhancers etc. which provided better yields. On the other hand, the farmers who were practicing mixed farming had either a dairy or a poultry farm attached to their crop fields. They had basically two sources of income, one from the field crops grown and the other from the dairy or poultry farms. Those who had cattle, sold milk and milk products like paneer, khoya*,* and sweets made by milk, etc. on their local shops. The farmers who

had poultry farmers sold birds and eggs as per their capacity. Thus, they had an additional source of income apart from the selling of the field crops in the nearby *mandis*. They were also found to be using cattle dung, or poultry litter into the fields as a source of manure. The farmers practicing diversified farming basically had more than two alternatives on the same farm. For example, the farmers growing field crops, running a poultry or dairy farm and having a small shed for mushroom cultivation; or the farmer taking simultaneously two crops (such as intercropping) along with earning from dairy or poultry and having a small pond on the farm for fish cultivation or running both poultry and dairy farms along with field cultivation of crops. This ensured diverse alternatives of income to the farmers.

The studies including Chauhan [21], Meena [22] and Chauhan [23] were found to contradict the findings of present investigation. The above-mentioned studies reported that majority of the farmers in Almora, U.S. Nagar and Dehradun districts of Uttarakhand respectively were practicing mixed farming. Another contradictory study Mandal (2018) revealed that maximum farmer respondents in West Bengal were following diversified farming.

3.8 Innovativeness

The data regarding distribution of respondents on the basis of their innovativeness is given in Table 2. It clearly indicates that almost half of the farmer respondents (49.19%) exhibited medium level of innovativeness. Meanwhile, 28.05 per cent of the respondents possessed high level of innovativeness and 22.76 per cent of the farmers showed low level of innovativeness. The findings show that the farmers were willing to try new and better alternatives of stubble management than to just burn the stubble. In fact, many of them have adopted and used measures like Happy Seeder, harvesting through SMS mounted combine harvesters, etc. However, the experiences of the farmers about using these alternatives varied from farmer to farmer and some farmers reverted back to burning the stubble.

The above findings were found to be in line with those of Roy [3] which also reported that majority of the farmers in Punjab (56.67%) and West Bengal (46.67%) exhibited medium level of innovativeness when it comes to considering the new ideas related to stubble management. The study conducted by Kumar (2008) and Kumar et

al. [24], Sharma et al. [6] conducted in Punjab also support the above findings.

3.9 Risk Orientation

The Table 2 depicts the data regarding the distribution of farmer respondents on the basis of their risk orientation. It can be inferred that maximum number of respondents (47.15%) possessed medium level of risk orientation. On the other hand, 30.49 per cent farmers showed high while 22.36 per cent farmers exhibited low levels of risk orientation.

During the informal discussions, it was revealed that farmers having larger land holdings; mixed or diversified farming or any other source of income apart from agriculture had options to fall back upon them for sustained income. They were found enthusiastic to take even more risks from these enterprises to earn additional income. Thus, they showed medium to higher risk orientation. On the other hand, the farmers following rice wheat mono cropping system got Minimum Support Price (MSP) on both these crops, thus leading to their easy marketing. Production constraints, good marketing facilities, satisfactory income from the two crops, less efforts required on the part of the farmers as compared to other cropping practices explains the lower risk orientation among other farmers.

Studies including Roy [3], Sharma et al. [6] and Lyngdoh [9] also reported that most of the farmers in Punjab showed medium to higher levels of risk orientation.

3.10 Scientific Orientation

The data regarding distribution of respondents on the basis of their scientific orientation has been given under in Table 2. It clearly reveals that majority of the farmers in the study area (57.32%) showed medium level of scientific orientation, followed by farmers belonging to 'high' category of scientific orientation who constituted 25.61 per cent of the total sample. It was also found that 17.07 per cent farmers exhibited 'low' level of scientific orientation.

Punjab is one of the most agriculturally advanced states in the country. The state has thrived upon the success of Green Revolution of 1960s and led the farmers to turn to scientific methods of agriculture. The farmers of Punjab believe that scientific outlook has helped them come a long way since the Green revolution in terms of increased incomes and improved standards of living. This could be clearly seen in the above findings as well which depict that majority of the farmers showed medium to high level of scientific orientation.

The current findings stand in line with those of Johnson and Monoharan [25], Pandey et al. [26] and Kumar et al. [24] and Lyngdoh [9] which also reported similar results.

3.11 Ecological Consciousness

The Table 2 holds the data regarding distribution of the respondents according to their ecological consciousness. It indicates that maximum respondents were categorized under high category. It was also found that more than a quarter of respondents (26.42%) showed medium level while around one-fifth of the respondents (19.92%) exhibited low level of ecological consciousness. The farmers in the study area were found to be aware of the importance of a healthy environment and also of the effects of their actions on the nature and other living beings. However, in some cases, they were more concerned about the issues which affected them immediately like those related with the timely sowing of the wheat crop and costly available alternatives to manage the stubble.

The studies conducted in Punjab by Roy [3] and Lyngdoh [9] reported similar results. They also found that majority of the farmer respondents (more than 60% in both cases) showed high levels of ecological consciousness.

3.12 Economic Motivation

The perusal of Table 2 which indicates the distribution of respondents according to their economic motivation shows that maximum number of respondents (42.28%) exhibited high economic motivation. Further, it was observed that 36.99 per cent of the farmer respondents were categorized under medium and 20.73 per cent respondents were placed under low economic motivation categories.

During the informal discussions, it was noted that the economic gains mattered a lot to the farmers in the study area. The prestige and status in the society were placed quite high in the minds of the farmers, both of which were believed to be enhanced with money. Hence, the farmers who had lesser incomes were working hard to increase it while who were better off, were trying to at least maintain or further elevate their status.

Table 2. Various characteristics of farmers

Characteristics	Frequency	Percentage (%)
Age		
Young (<26 years)	38	15.44
Middle (26-50 years)	161	65.46
Old (>50 years)	47	19.10
Gender		
Men	224	91.06
Women	22	8.94
Education		
Illiterate	17	6.91
Functionally literate	30	12.20
Primary education	32	13.01
High school	47	19.10
Intermediate	54	21.95
Graduate	53	21.54
Post graduate	13	5.29
Size of the landholding		
Marginal (< 2.5 acres)	46	18.70
Small (2.5-5 acres)	54	21.95
Semi-medium (5-10 acres)	67	27.24
Medium (10-25 acres)	48	19.51
Large (> 25 acres)	31	12.60
Annual income		
Low (< Rs. 50,000- Rs. 4,50,000)	127	51.63
Medium (Rs. Rs. 4,50,000- Rs. 8,50,000)	73	29.67
High (Rs. 8,50,000- Rs. 12,50,000)	46	18.70
Livestock Possession		
Poultry birds	20	8.13
Smaller milch animals (Sheep or Goat)	9	3.66
Larger milch animals (Cow or buffalo)	243	98.78
Draught animals (Oxen)	11	4.47
Type of Farming		
Specialized	113	45.93
Diversified	63	25.61
Mixed	70	28.46
Innovativeness		
Low (<17)	56	22.76
Medium (17-23)	121	49.19
High (> 23)	69	28.05
Risk Orientation		
Low (<19)	55	22.36
Medium (19-25)	116	47.15
High (>25)	75	30.49
Scientific Orientation		
Low (<19)	42	17.07
Medium (19-25)	141	57.32
High (> 25)	63	25.61
Ecological Consciousness		
Low (<15)	59	19.92
Medium (15-19)	75	26.42
High (>19)	112	45.53
Economic Motivation		
Low (<19)	51	20.73
Medium (19-25)	91	36.99
High (>25)	104	42.28

A very few farmers exhibited the virtues of satisfaction and contentment with whatever they had.

The findings reported in the works of Joshi [12] and Lyngdoh [9] stand in line with the present findings as both of them found that most of the

farmers showed high economic motivation in Uttar Pradesh and Punjab respectively.

3.13 Awareness Related to Stubble Management Measures

The Table 3 depicts the distribution of respondents on the basis of their awareness regarding various stubble management measures. It is evident from the following data that majority of respondents (97.96%) were aware about Happy Seeder/Zero tillage, followed by thatching (89.43%), in-situ incorporation (86.17%) and use of stubble as mulching material (71.54%). The rest of the measures in the order of decreasing level of awareness were found as: use of stubble in packing material (58.13%), mushroom production (38.21%), fuel purposes (28.04%), biogas production (25.20%) and bio char production (23.17%). It was further noticed that awareness about measures like compost making (13.82%), charcoal production (6.50%) and methane gas production (5.28%) was among least number of farmer respondents.

Further, Table 4 depicts the level of awareness of respondents about various stubble management measures mentioned in Table 3. It can be clearly observed from the following data that maximum number of respondents (45.93%) was having medium level of awareness, i.e. out

of above mentioned 13 stubble management measures, they were aware of five to nine measures. On the other hand, about 29.27 per cent of the respondents were aware of more than nine stubble management measures and thus, belonged to high awareness level. It was also observed that just less than a quarter of respondents (24.80%) were aware of less than five stubble management measures. Hence, they were classified under low awareness category.

The informal discussions revealed that the farmers although had awareness about various stubble management measures but they were not using them as none of them was cost efficient and more convenient than burning. This was also stated in the study conducted by Roy and Kaur (2016) in Punjab.

3.14 Information Seeking Behaviour

In the present study, information seeking behaviour of the farmer respondents was operationalized as the frequency of contact or exposure of the respondent to different sources viz. personal localite, personal cosmopolite, mass media and extension methods for obtaining information on agriculture and related aspects. The information seeking behaviour of the farmers was studied under four categories as described below.

Table 3. Distribution of respondents on the basis of awareness related to stubble management measures (n=246)

S. No.	Stubble Management Measures	Frequency	Percentage (%)
1	Charcoal production	16	6.50
2	Methane gas production	13	5.28
3	Biogas production	62	25.20
4	Mulching material	176	71.54
5	Mushroom production	94	38.21
6	Thatching	220	89.43
7	Paper mill industry	51	20.73
8	Compost making	34	13.82
9	Fuel purpose	69	28.04
10	Packing material	143	58.13
11	Bio char production	57	23.17
12	In-situ incorporation	212	86.17
13	Happy seeder/Zero tillage	241	97.96

Multiple responses were allowed

Table 4. Distribution of respondents on the basis of level of awareness related to stubble management measures (n=246)

S. No.	Level of Awareness about stubble management measures	Frequency	Percentage (%)
1.	Low (less than 5)	61	24.80
2.	Medium (In between 5 and 9)	113	45.93
3.	High (more than 9)	72	29.27

3.14.1 Information seeking behaviour from personal localite sources

The data in Table 5 represents the distribution of respondents according to their frequency of seeking information from personal localite sources. It can be inferred from the data that among the personal localite sources of information, majority of the respondents (55.70%) sought information from relatives on occasional basis with weighted mean score (WMS) of 2.06 and rank I. It was also found that 52.44 per cent of the farmers sought information from progressive farmers on the occasional basis which stood II with WMS of 2.04. The results further indicate that neighbours, with WMS 1.95 were the third most frequently utilized sources of agricultural information in the study area with 46.34 per cent of the farmers depending on them occasionally. The friends were the second least with 12.60 per cent regular usage with WMS of 1.69 and the local leaders were the least preferred information source with WMS of 1.60 and just 6.50 per cent regular information seeking by the farmers in the study area.

It was observed during informal discussions that some farmers had purchased some farm implements on shared basis with their relatives. So, the majority of information sought from relatives was based on type of farm machinery to be utilized for various operations. This included the information regarding the time, method and frequency of use of farm implements. The second most frequent information source was the progressive farmers in the study area. This shows that the farmers had more trust on the information supplied by someone of their own kind, i.e. a farmer himself. It was noticed that the progressive farmers had higher degree of cosmopolite nature than the rest of the farmers in

terms of exchange of agricultural information. The farmer respondents obtained information from progressive farmers regarding new varieties, techniques of stubble management, etc. The neighbours were also rated high as the sources of agricultural information. It was noticed that neighbouring farmers took advice and discussed issues like time of sowing, irrigation and harvesting, etc. among each other. In some villages, it was noticed that the neighbouring farmers had a good understanding among themselves and rented farm machines like harvesters from the common vendor, which ultimately saved some cost.

3.14.2 Information seeking behaviour from personal cosmopolite sources

The distribution of respondents according to the frequency of seeking information from personal cosmopolite sources is presented in the data in Table 6. A cursory look on the results indicates that among personal cosmopolite sources, the Input retail shops were most frequently sought by the respondents with weighted mean score (WMS) of 2.30 and corresponding rank I. Company Agents from various input companies like those of seeds, chemicals etc. were the second most frequently sought information source with WMS of 1.63. The third most popular personal cosmopolite source of information was found to be the Field Officer from the banks with a WMS of 1.75, followed by KVK-SMS, Agricultural Officer and Block Development Officer respectively with weighted mean scores of 1.64, 1.35 and 1.32 respectively. Therefore, it can be inferred that for seeking agricultural information, Input retailers, Company Agents and Field Officers from the banks were perceived as the most preferred personal cosmopolite sources by the respondents in the study area.

Table 5. Distribution of respondents according to their frequency of seeking information from personal localite sources (n=246)

S. No.	Personal localite sources	Seeking behaviour						Weighted mean score (WMS)	Rank
		Regular		Occasionally		Never			
		F	%	f	%	f	%		
1	Friends	31	12.60	110	44.72	105	42.68	1.69	IV
2	Neighbours	60	24.40	114	46.34	72	29.26	1.95	III
3	Relatives	62	25.20	137	55.70	47	19.10	2.06	I
4	Progressive farmers	64	26.02	129	52.44	53	21.54	2.04	II
5	Local leaders	16	6.50	118	47.97	112	45.53	1.60	V

Multiple responses were allowed

Table 6. Distribution of respondents according to their frequency of seeking information from personal cosmopolite sources (n=246)

Sl. No.	Personal cosmopolite sources	Seeking behaviour						Weighted mean score (WMS)	Rank
		Regular		Occasionally		Never			
		f	%	f	%	f	%		
1	Agriculture Officer (AO)	0	0	87	35.37	159	64.63	1.35	V
2	Block Dev. Officer (BDO)	0	0	79	32.11	167	67.89	1.32	VI
3	Field Officer (Bank)	38	15.45	110	44.71	98	39.84	1.75	III
4	KVK-Subject Matter Specialists (SMS)	21	8.54	117	47.56	108	43.90	1.64	IV
5	Input Retail Shops	95	38.62	130	52.85	21	8.53	2.30	I
6	Company Agents	43	17.48	106	43.09	97	39.43	1.78	II

Multiple responses were allowed

The results show that the input retailers and company agents of various input companies were the most preferred sources of the information among personal cosmopolite sources. The reason behind this might be that the most of the farmers in study area were using various kinds of inputs like seeds, fertilizers, chemicals for pest and insect control etc. for which, they visited the input dealers for purchasing the inputs on a quite frequent basis. The informal discussions revealed that during these visits to the input retail shops, farmers used to describe the condition of their standing crops to the shopkeepers and accordingly, they suggested the input to be used to the farmers. The suggestions ranged from the type of chemical, brand of chemical and the dosage to the frequency of usage of those inputs. Thus, farmers got a wide range of information from a single point of contact. On the other hand, Punjab being a very competitive market for all kinds of farm inputs, from chemicals to farm machinery, the companies have appointed agents at various cadres to establish direct contact with the farmers for facilitating their sales. The second most frequently used sources were these company agents. They used to contact the farmers and provided them information about latest products they had to offer and sometimes, also delivered those products at the farmers' doorsteps. Famers also utilized that information to compare the quality and prices of the products with other agents and input retailers. The field officers from the banks had a similar approach of establishing the rapport and contact with the farmers but their information was often limited to loans and credit.

3.14.3 Information seeking behaviour from mass media sources

The data in Table 7 represent the distribution of respondents according to their frequency of seeking information from mass media sources. The data clearly indicates that mobile phones, television and newspaper were the top three sources sought on regular basis by most of the respondents (45.12%, 41.06% and 21.54% respectively). While on the basis of Weighted Mean Scores (WMS), television was rated as the topmost mass medium used by the farmer respondents with the score of 2.26. According to the WMS, the rest of the sources were found to be in the order as mobile phones, newspaper, radio, natak/plays and farm magazines with the scores of 2.24, 1.82, 1.39, 1.34 and 1.21 respectively. Informal discussions revealed that almost all the farmers had access to television from which they obtained farm information. Some of them referred to DD Kisan and DD Punjabi and other regional news channels particularly for agricultural updates and information. Television was followed by mobile phone in terms of most widely used mass medium information source. The farmers utilized SMS service, social media platforms on mobile phone for obtaining and sharing agricultural information. The third most widely used mass medium was newspaper, one of the cheapest and most easily accessible information sources across the farm families in the study area. They were also available in regional language, which made them even more easily understood by the masses.

Radio was the next most utilized mass medium for agricultural information. Only 37.40 per cent of the respondents used radio and that too occasionally because most of the farmers have switched from radio to television and mobile phones over a period of time. Natak/plays were organized by government agencies and PAU to sensitize farmers on various sensitive issues like stubble burning, farmer suicides etc. The plays were organized mainly by students from colleges and schools in villages to address the crucial issues. Although just around one-third of the

farmer respondents (34.55%) were found to have come across such plays occasionally but it was believed that it could be a very persuasive medium in coming times to propagate social messages. The farm magazines were the least consulted mass medium (78.46% of the respondents never utilized) for gathering agricultural information as most of the farmers did not have access to this medium and they were also least interested to use it. The ones having access to the farm magazines occasionally utilized it and the magazines were mostly provided by the company agents which basically had detailed information about their products.

An attempt was also made to map the usage of social media and SMS services (via mobile phone) by the farmer respondents and a few interesting observations were recorded. The data indicates that WhatsApp was the most commonly used social media platform among the farmer respondents with a WMS of 2.14, followed by SMS service, Facebook, YouTube and Twitter with the WMS scores of 2.04, 1.89, 1.77 and 1.34 respectively. Within mobile phone category, 39.83 per cent of the farmers were regularly using SMS services regulated by Punjab Agricultural University (PAU), private companies like Mahindra, Tata, etc. and KVKs. They got information regarding crop-specific agricultural practices, weather predictions, etc. on a regular basis in regional language as well as in Hindi and English via SMS. Social media platforms like WhatsApp, Facebook, YouTube and Twitter were also used by the farmers to gather farm related information. Informal discussions also revealed that many farmers were members of groups on platforms like WhatsApp and Facebook which provided latest information and an opportunity to discuss about various queries related to agriculture. Some of the groups were farmers only while some had linkages with agricultural scientists from as well. Apart from these, farmers also utilized YouTube for getting information related to new and better techniques for agricultural operations. A few farmers accessed Twitter for getting updates related to latest policies and technologies issued by various government and private agencies. Platforms like Facebook and Twitter were also used for raising issues by the young farmers. It was believed that social media has provided power to farmers to raise their voices at the level where they could be heard.

It can be concluded from the above findings that television and mobile phones were the most frequently utilized mass media sources for information on agriculture in the study area. The reason might be due to their easy availability and accessibility. It was also noted that comparatively few numbers of respondents used newspaper, radio and magazines because of lack of access and interest.

The results are in line with the findings of Ansari and Sunetha [27] who reported that 97 per cent of farmer respondents used television and all of them (100 per cent) had access to mobile phones. Raghuvanshi [28] also observed in a study that the most regularly used mass medium was television by 93.65 per cent of the respondents. Similar observation was made by Papnai [29] and Ansari et al [30] who reported that mobile phones ranked first in terms of utilization as information source followed by television and radio respectively.

Table 7. Distribution of respondents according to their frequency of seeking information from mass media sources (n=246)

S. No.	Mass media sources	Seeking behaviour						Weighted mean score (WMS)	Rank
		Regular		Occasionally		Never			
		f	%	f	%	f	%		
1	Newspaper	53	21.54	96	39.02	97	39.43	1.82	III
2	Farm magazine	0	0	53	21.54	193	78.46	1.21	VI
3	Natak/Plays	0	0	85	34.55	161	65.45	1.34	V
4	Radio	2	0.81	92	37.40	152	61.79	1.39	IV
5	Television	101	41.06	105	42.68	40	16.26	2.26	I
6	Mobile Phone	111	45.12	85	34.55	50	20.33	2.24	II
(i)	WhatsApp	80	32.52	120	48.78	46	18.70	2.14	
(ii)	Facebook	45	18.30	130	52.84	71	28.86	1.89	
(iii)	Twitter	18	7.32	49	19.92	179	72.76	1.34	
(iv)	YouTube	40	16.26	109	44.31	97	39.43	1.77	
(v)	SMS	98	39.83	60	24.40	88	35.77	2.04	

Multiple responses were allowed

3.14.4 Information seeking behaviour from extension education methods

The distribution of respondents according to their frequency of seeking information from extension education methods is given in Table 8. It can be inferred from the data that for respondents in the study area, most frequently utilized information extension method was *Kisan Mela* with weighted mean score (WMS) of 1.97. The other extension education methods followed in the order as meetings, group discussions, demonstrations, field trials and workshops with WMS of 1.55, 1.50, 1.45, 1.42 and 1.41 respectively. The reason behind these observations might be explained by to the fact that the farmers were not interested in getting engaged in various extension activities due to lack of time.

Apart from that, some farmers expressed their inconvenience to attend such extension activities because the agencies organizing these activities were distant from their respective villages. On the other hand, the *Kisan Melas* showcased new technologies including new varieties, farm implements, etc. for which farmers were keen to know about. The farmers also attended the discussion sessions with the scientists and experts during the fairs. *Kisan Melas* offered more options for fun, frolic and recreation for all the family members. Thus, some farmers used to attend the *Kisan Melas* with their families even if they had to travel some distance for it.

The overall information seeking behaviour of the respondents is presented in the Table 9 below. It is clear from the given data that maximum percentage of the respondents (51.63%) had medium information seeking behaviour followed by 27.64 per cent of respondents who had high information seeking behaviour. Only 20.73 per cent of respondents showed low information seeking behaviour.

Similar findings were found in the studies conducted by Joshi [12], Mandal (2018), Palvi et al. [14] and Saklani [15] in which it was reported that most of the farmer respondents showed medium level of overall information seeking behaviour.

It can be deduced from the Weighted Mean Scores (given in brackets) across all the type of information sources that the farmers in the study area were mostly dependent on the input retail shop owners (2.30), followed by television (2.26), mobile phones (2.24), relatives (2.06) and progressive farmers (2.04) for agricultural information. Within the mobile phone category, the use of social media platforms like WhatsApp (2.14) and Facebook (1.89) along with the SMS service (2.04) was also quite frequently observed. The use of social media in particular was to share information through multimedia options like text, video, audio, etc., to raise opinions, discuss problems and find solutions to those problems.

Table 8. Distribution of respondents according to their frequency of seeking information from extension education methods (n=246)

S. No.	Extension education methods	Seeking behaviour						Weighted mean score (WMS)	Rank
		Regular		Occasionally		Never			
		f	%	f	%	f	%		
1	Meetings	33	13.41	71	28.87	142	57.72	1.55	II
2	Group Discussion	18	7.32	88	35.77	140	56.91	1.50	III
3	Demonstrations	11	4.47	89	36.18	146	59.35	1.45	IV
4	Field Trials	9	3.66	86	34.96	151	61.38	1.42	V
5	*Kisan Mela*	60	24.39	120	48.78	66	26.83	1.97	I
6	Workshops	5	2.03	91	37.00	150	60.97	1.41	VI

Multiple responses were allowed

Table 9. Distribution of respondents on the basis of their information seeking behaviour (n=246)

S. No.	Information seeking behaviour	Frequency	Percentage (%)
1.	Low (Less than 46)	51	20.73
2.	Medium (In between 46 and 52)	127	51.63
3.	High (More than 52)	68	27.64

Thus, these channels might prove helpful in communicating information to the farmers regarding measures against stubble burning. For example, a proven product as an alternative to stubble burning can be made available at the nearest input retail shop, advertised through television and social media and verbally propagated through progressive farmers and other preferred localite channels. In this way, the farmers may be exposed to a potential solution to stubble burning by using these sources or channels.

4. CONCLUSION

Stubble burning has been a problem of grave concern in the recent years especially in northern India. Many technological and legal interventions have been introduced by the government at both central and state levels but this menacing act is far from ending. The present study focused on identifying the profile characteristics of the farmers which could affect the stubble burning behaviour of the farmers. The findings of the study will help in segmentation and profiling of the target farmers based on similar characteristics. The profiling and segmentation of the target audience based on these characteristics will also serve as a database for the extension agencies and policy makers to plan and design similar interventions pertaining to other issues of farmers that pose a potential threat to environment, e.g. ruthless use of chemical fertilizers, etc. The findings also revealed the most widely utilized communication channels for seeking agricultural information by the farmers. These may also be utilized to disseminate the messages and establishing communication with the farmers in an effective manner. These findings will serve as a valuable tool for the government functionaries to construct and implement various programs to stop the stubble burning practice. Overall, these will also aid in crafting a process of behaviour change regarding several other issues related to farmers and agriculture.

ACKNOWLEDGEMENTS

COMPETING INTERESTS

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