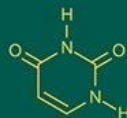


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Holmukhe SS
Ph.D Scholar, Department of
Agricultural Extension
Education, VNMKV,
Parbhani, Maharashtra, India

Kadam RP
Professor & HOD, Department
of Agricultural Extension
Education, VNMKV,
Parbhani, Maharashtra, India

Patil DK
Principal Scientist, ARS,
Badnapur, Jalna, VNMKV,
Parbhani, Maharashtra, India

Relational analysis through components of socio-economic impact of BDN 711 growers in Marathwada region

Holmukhe SS, Kadam RP and Patil DK

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Abstract

Background: In Maharashtra in 2013-14 area under Pigeonpea was 11.41 lakh hectares and productivity was 906 kg / ha. Majority of the farmers cultivated Pigeonpea as a cash crop, but it cannot see to all farmers due to dry land cultivation with using long duration and local varieties. In 2011-12 VNMKV Parbhani has developed BDN 711 new variety of Pigeonpea to overcome the problems and increasing the productivity of Pigeonpea in Maharashtra.

Methods: The present study was undertaken in the Marathwada region of Maharashtra state during the years 2021–22. Purposively on the basis of the maximum number of farmers cultivating red gram (BDN 711), were found in these two districts and Four talukas sixteen villages were selected for conducting the study. So from each village, fifteen farmers were selected purposefully from that list, and we considered them respondents, thus making a sample of 240 respondents. To study the impact, some respondents were analysed before and after cultivation of BDN 711, i.e., recall memories of farmers. An ex-post facto research design was adopted in this study.

Result: The findings with regard to total social impact change percentage divided by the overall percentage of each component before and after cultivation of BDN 711 show that the farmers have established 14.44 % social impact.

Keywords: BDN 711, social impact, before cultivation, after cultivation etc.

Introduction

Red gram is a major basis of protein in South Asia and the Indian subcontinent, predominantly for people whose diet is based on cereal. The seeds are high in protein and amino acids like lysine, methionine, and tryptophan, as well as iron and iodine. Red gram plants also help sustain soil fertility by fixing special nitrogen in a symbiotic relationship with Rhizobium bacteria in their root nodules.

Pigeonpea as are small, round to oval, mostly cherry-red coloured dicotyledonous seeds in the legume family. They do, however, come in a variety of colour patterns, such as yellow, brown, variegated, and so on. Since its domestication in the Indian subcontinent at least 3,500 years ago, it is now farmed as a significant pulse crop throughout Asia's tropics and subtropics, as well as Sub-Saharan Africa and Latin America, for its nutritious dry seeds.

Objectives

Relationship between the profiles of the red gram (BDN-711) growers with the socio-economic impact on the red gram (BDN-711) growers.

Materials and Methods

This study used an ex-post facto research design. Because independent variables are intrinsically non-manipulable, ex-post facto research design is a systematic empirical investigation in which the researcher does not have direct control over them. A multistage sampling technique was used for the study. Sampling was done at five stages viz., the selection of districts, selection of mandals, selection of villages and selection of respondents. The present study was undertaken in Marathwada region of Maharashtra state during the year 2021-22. In purposively selected three districts on viz., Chhatrapati Sambhajnagar (Aurangabad) and Jalna districts of Marathwada region of Maharashtra state on the basis of

Corresponding Author:
Holmukhe SS
Ph.D Scholar, Department of
Agricultural Extension
Education, VNMKV,
Parbhani, Maharashtra, India

maximum number of farmers following cultivation of BDN 711 were found in these two districts. The talukas also selected purposively on the basis of maximum number of farmers cultivating red gram BDN 711. So from Chhatrapati Sambhajnagar (Aurangabad), district two talukas were selected namely Paithan and Gangapur, from Jalna district two talukas namely Ambad and Badnapur were selected. Thus, total four talukas were selected. From each selected taluk 4 villages were selected purposively on the basis of maximum number of farmers cultivating red gram BDN 711 for that purpose list obtained from NARP and KVK Aurangabad and Jalna, VNМКV, Parbhani hence sixteen villages were selected for conducting the study. So from each village ten respondent organic following farmers were selected randomly from that list and we considered them as respondents, thus making a sample of 240 respondents.

Ex-post facto research design was adopted in this study. The findings with regard to the selected profile characteristics of the respondents indicate that of the respondents i.e personal, psychological, socio-economic characteristics were belonged to education, family size, occupation, land holding, farming experience, marginal area under pulses crop in 2022 -23, cropping pattern, sources of irrigation, annual income, social participation, information seeking behaviour, scientific orientation, economic motivation, innovativeness, high knowledge. The present study was undertaken in Marathwada region of Maharashtra state during the year 2018 and 2022. For socio-economic impact of red gram BDN 711 selected as dependent variable for study. The statistical methods and tests such as mean, standard deviation, frequency and percentage, Pearson's coefficient of correlation, multiple regression analysis and path analysis was used for the analysis of data. For this constraints and suggestions the statistical tools was used i.e. frequency, percentage and rank given as per the highest responded respectively.

Due to erratic climatic changes more impacting on the production of pigeon pea and socio-economic status of farmers in Marathwada region. The improved variety developed by ARS, Badnapur, and white seeded BDN 711 which has increased assured higher production after following the recommended cultivation practices by the farmers. Also while interview the BDN 711 cultivated farmers given suggestions, requirements to overcome the constraints in BDN 711 cultivation.

Results and Discussion

Coefficient of Correlation

The value of the coefficient of correlation as obtained by the formula will always lie between ± 1 . When $r = +1$, it means that there is perfect positive correlation between the variables. When $r = -1$, it means that there is perfect negative correlation between the variables. When $r = 0$, it means there is no relationship between the independent and dependent variables hence, the study shows the positive correlation with the Education, Size of Family, farming experience and Social Participation, Information seeking behaviour, Scientific orientation, Economic Motivation, Innovativeness, Knowledge these are showing highly positive and significant relationship with the socio-economic impact of red gram BDN 711 with above variables.

Education vs socio-economic impact of red gram (BDN 711)

Table 1 revealed that, there has positive and significant (0.151^*) relationship between education of red gram (BDN 711) growers and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.05 % of level of probability.

Table 1: Ascertain association between of profile of red gram growers with overall socio-economic impact of red gram (BDN 711)

Sr. No	Independent Variable	Coefficient of correlation (r)
1	Education	0.151*
2	Size of Family	0.158*
3	Occupation	0.119 ^{NS}
4	Land Holding	-0.075 ^{NS}
5	Farming experience	0.200**
6	Area under pulses crop	0.015 ^{NS}
7	Cropping pattern	-0.096 ^{NS}
8	Sources of Irrigation	-0.040 ^{NS}
9	Annual Income	0.091 ^{NS}
10	Social Participation	0.279**
11	Information seeking behaviour	0.174**
12	Scientific orientation	0.201**
13	Economic Motivation	0.185**
14	Innovativeness	0.197**
15	Knowledge	0.198**

(*Significant at 0.05 level of probability)

NS=Non-significant

**Significant at 0.01 level of probability)

From the result it shown that majority of the red gram (BDN 711) growers were educated, but some growers were illiterate. Illiterate growers get information through social participation, information seeking behaviour, scientific orientation, economic motivation, innovativeness, knowledge regarding the farm cultivation package of practice, farm inputs, marketing farm produce. They actively participating in the farmers field visits, meeting, and helps them to get more benefit through their red gram (BDN 711) variety. It lead to get more ideas and knowledge related to their production by information seeking behaviour and scientific orientation. Hence Null hypothesis has been accepted.

The similar findings with the result of Narayanmoorthy (2000) [8], Sable (2013) [9], Supe *et al.* (2017) [11] and Agalawe D.D. (2019) [2], Kanhadkar, B.R *et al.* (2019) [5], Singh *et al.* (2022) [12].

Size of Family vs socio-economic impact of red gram (BDN 711)

Table 2 revealed that, there has positive and significant (0.158^*) relationship between size of family of red gram growers and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.05 % of level of probability.

The size of family matters while cultivation of any crop which helps in reduction of labour charges. Hence Null hypothesis has been rejected.

The present investigation has the similar findings with the result of Abdissa *et al.* (2017) [1], Supe *et al.* (2017) [11], Kauthekar (2015) [6].

Occupation vs socio-economic impact of red gram (BDN 711)

Table 2 revealed that, there was positive and non-significant (0.119^{NS}) relationship between occupation of red gram growers and their socio-economic impact of red gram (BDN 711) was found to be non-significant at 0.05 % of level of probability.

It indicated that majority of red gram growers were belong to farming as occupation. They directly and indirectly depend on farming as main occupation because mostly income generate from farming occupation. Red gram growers also earn money from other additional occupation like labour, allied agriculture, dal mill as business and services. These additional occupation help the red gram growers to improve land and change the cropping pattern of growing crops, red gram growers gives help in term of accessing farm input like seed, fertilizer, machinery, tools, agriculture information and procure the farm produce at good prices as compare to private dealer. Hence Null hypothesis has been rejected.

The similar findings with the result of Sable (2013) ^[9], Kauthekar (2015) ^[6].

Land holding vs socio-economic impact of red gram (BDN 711)

Table 2 revealed that, there was negative and non-significant (-0.075^{NS}) relationship between land holding of red gram growers and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.05 % of level of probability.

Size of land holding is a symbol of economic standing of a person in social system. It showed that majority of socio-economic impact of red gram (BDN 711) were belonging to small and marginal farmers due to farmers' joint family divided into nuclear family and decline the average size of land holding. Red gram (BDN 711) helps to small and marginal farmers to cultivate the land under vulnerability condition due to climate change and natural calamities also drought prone areas by providing drought resistant and indeterminate varieties, input, credit, technology and market. Hence Null hypothesis has been accepted.

The similar findings with the result of Kanhadkar, B.R. *et al.* (2019) ^[5], Agalawe, D.D. (2019) ^[2],

Farming experience vs socio-economic impact of red gram (BDN 711)

It was revealed from Table 2 that there has a positive and highly significant (0.200^{**}) relationship between the farming experience of red gram growers and the socio-economic impact of red gram (BDN 711).

From the result shows that majority of the farming experience before cultivation of the BDN 711 were not that much educated but due the information seeking behaviour they have got lot of information regarding the dealing with cultivation recommended practices. Actively participating in the group discussions, training helped them to gain more profit through their cultivation practices and cropping pattern. It leads to get more ideas and information related to the production technologies and seed varieties by information seeking behaviour. Hence Null hypothesis has been rejected.

The similar findings with the result of Supe *et al.* (2017) ^[11], Kanhadkar, B.R. *et al.* (2019) ^[5], Singh *et al.* (2022) ^[12].

Area under pulses crop vs socio-economic impact of red gram (BDN 711)

It was revealed from Table 2 that there was a negative and non-significant (-0.096^{NS}) relationship between the area under pulses crop of red gram growers and the socio-economic impact of red gram BDN 711.

The result shows that the crops growing under area under pulses crops has increased but showing negative and non-significant with socio-economic impact because the area cropping pattern. The farmers has following intercropping with cotton and Pigeonpea. Null hypothesis has been accepted.

The similar findings with the result of Agalawe D.D. (2019) ^[2],

Cropping pattern vs socio-economic impact of red gram (BDN 711)

It was revealed from Table 2 that there was a positive and non-significant (0.015^{NS}) relationship between the cropping pattern of red gram growers and the socio-economic impact of red gram (BDN 711).

From the data shows that the cropping pattern with intercropping i.e cotton + pigeon pea, or sole cropping also helps in increasing annual income with better irrigation sources. But BDN 711 variety is drought resistant hence though water stress level increased then also it gives good yield. After cultivation of BDN 711 though it is indeterminate and early variety the farmers could sow another crop in Rabi season which induce annual income of the farmers. Null hypothesis has been rejected.

The present investigation found similar findings with the result of Jamanal S. (2019) and Singh *et al.* (2022) ^[12] (i.e.) crop production, cropping pattern.

Sources of Irrigation vs socio-economic impact of red gram (BDN 711)

It was revealed from Table 2 that there was a negative and non-significant (-0.040^{NS}) relationship between the sources of irrigation of red gram growers and the socio-economic impact of red gram (BDN 711).

The data shows that sources of irrigation tube well, well, and canal has provided the better sources for irrigation which leads better production. Better sources can increase the production hence can induce socio-economic impact. Before cultivation of BDN 711 the farmers did not increase better production per hectare area. It implied that there was scope to increase the use of these resources on dry land farm because these recourses were found to be underutilization in production of major crops. Null hypothesis has been accepted.

The similar findings with the result of Sharma *et al.* (2005) ^[10], Kauthekar (2015) ^[6].

Annual Income with socio-economic impact of red gram (BDN 711)

Table 2 revealed that, there was positive and non-significant (0.091^{NS}) relationship between annual income of red gram growers' and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.01 % of level of probability.

It indicated that majority of red gram growers were belonging to medium annual income, red gram growers' farm produce at MSP and reducing fluctuation in price of farm produce. Most of the Beneficiaries also generate

income from additional occupation like labour, allied agriculture, dal mill as business and services. These source of occupation built farmer ability to purchase farm inputs, farm machinery and reducing indebtedness among the beneficiaries. BDN 711 can overcome the effect of dry spells during vegetative and or reproductive stages of crops resulting in increased rainwater use efficiency, better performance of crops and additional net returns. Null hypothesis has been rejected.

The similar findings with the result of Sharma *et al.* (2005) [10], Kauthekar (2015) [6].

Social Participation vs socio-economic impact

Table 2 revealed that, there was positive and highly significant (0.279**) relationship between social participation red gram growers' and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.01 % of level of probability.

It indicated that majority of red gram (BDN 711) growers' were belonging to medium social participation. Red gram (BDN 711) growers' work together small and marginal farmers for doing farming, ultimate aggregate contact among farmers that increases social participation in cooperative society, gram panchayat, self-help group, farmers union, different social media groups i.e. Whatsapp, YouTube etc. that increases knowledge of farmers in farming and marketing of farm produce. Null hypothesis has been rejected.

The similar findings with the result of Abdissa *et al.* (2017) [1], Supe *et al.* (2017) [11], Agalawe D.D. (2019) [2], Kanhadkar, B.R *et al.* (2019) [5] and Singh *et al.* (2022) [12].

Information Seeking Behaviour vs socio-economic impact of red gram (BDN 711)

Table 2 revealed that, there was positive and highly significant (0.174**) relationship between information seeking behaviour of red gram growers' and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.01 % of level of probability.

It indicated that majority of beneficiaries were belonging to medium Information Seeking behaviour. Through BDN 711 growers' farmers groups build contact of beneficiaries with extension personnel like agricultural assistant, village level extension worker, agriculture officers, Taluka Agril. Officer, Krishi vigyan Kendra's subject matter specialist etc. they provide technical guidance for improvement in crop production technology. They share idea about various scheme launched by state government and central government to get benefit directly from scheme. Red gram growers increases BDN 711 growers' participation by organizing meetings, group discussions, demonstration, field trial, etc. that build knowledge and attitude toward crop production and management. Null hypothesis has been rejected.

The similar findings with the result of Muthukumar (2000), Agalawe D.D. (2019) [2] and Kanhadkar, B.R *et al.* (2019) [5].

Scientific orientation vs socio-economic impact of red gram (BDN 711)

Table 2 revealed that, there was positive and highly significant (0.201**) relationship between scientific orientation of red gram (BDN 711) growers' and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.01 % of level of probability.

Red gram (BDN 711) growers' uses new method of farming that gives better result than old methods. Traditional method of farming changed with experience and new idea in farming by growers in order to elevation the standard of living. Null hypothesis has been rejected.

The similar findings with the result of Jayasankar (2000), Agalawe D.D. (2019) [2], Singh *et al.* (2022) [12].

Economic Motivation vs socio-economic impact of red gram (BDN 711)

Table 2 revealed that, there was positive and highly significant (0.185**) relationship between economic motivation of red gram (BDN 711) growers' and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.01 % of level of probability.

Red gram (BDN 711) growers' working towards earn more income and economic profit through cultivating and adoption new varieties. Null hypothesis has been rejected.

The similar findings with the result of Agalawe D.D. (2019) [2], Kanhadkar, B.R *et al.* (2019) [5].

Innovativeness vs socio-economic impact of red gram (BDN 711)

Table 2 revealed that, there was positive and highly significant (0.197**) relationship between innovativeness of red gram (BDN 711) growers' and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.01 % of level of probability.

Innovation adoption follows a systematic decision-making process. Although personal characteristics are important, widespread use of new technology requires a conducive social and institutional context. Because contexts vary by country or region, extension services providers should create institutions favorable for innovation adoption within a social system. Innovativeness is able to do new things. Red gram (BDN 711) growers' are more innovative because KVK's, agricultural universities, conducting different training sessions, demonstrations, agricultural fairs, farmers fairs, farmers field visits for timely technology dissemination. Hence, it facilitates the technical knowledge about cultivation practices, farm mechanization and introduce farmers with new occupations i.e dal mill. Null hypothesis has been rejected.

The similar findings of investigation with the result of Kanhadkar, B.R *et al.* (2019) [5], Singh *et al.* (2022) [12].

Knowledge vs socio-economic impact of red gram (BDN 711)

Table 2 revealed that, there was positive and highly significant (0.198**) relationship between knowledge of red gram (BDN 711) growers' and their socio-economic impact of red gram (BDN 711) was found to be significant at 0.01 % of level of probability.

Farmers having the knowledge about Red gram (BDN 711) variety i.e. improved variety BDN-711, short duration, escaping terminal drought, and wilt resistant hence alteration to intensify income from their farm produce and reducing cost of cultivation and use of production technology to reduce cost of production. Hence the hypothesis is rejected that knowledge is positively significant with the socio-economic impact of BDN711 at 0.05 percent level of significance. Null hypothesis has been rejected.

The similar findings with the result of Abdissa *et al.* (2017)^[1], Kanhadkar, B.R *et al.* (2019)^[5], Nair (2021)^[13] Singh *et al.* (2022)^[12].

Multiple regression analysis

It was found from table 2 that coefficient of determination (R^2) of the independent variable was 0.2131. It means that 21.31 per cent of total variation in the red gram growers (BDN 711) with overall impact of red gram (BDN 711) was explained by the 15 independent variables. The multiple regression coefficients presented in Table 2 further revealed that the independent variables didn't explain more about socio-economic impact of red gram (BDN 711) farmers.

It could be clearly noted that a correlation between X and Y has a value of $r = 0.4617$ and $r^2 = 0.2131$. Hence it shows positive but weak relationship of the independent variables with socio-economic impact of BDN 711 i.e dependent variable. This relationship could be better understood by computing the value of r^2 as mentioned above. The range of

r^2 is from 0 to 1. The remaining 78.69% might be due to the effect of extraneous variables.

The value of 't' showed that impact of red gram (BDN 711) was significantly related with land holding, annual income, social participation, innovativeness the regression coefficient of these variable were -1.292, 2.4373, 0.0648, -3.8797, -1.3237, 0.9054, -0.4788, -0.6913, 0.0001, 6.4339, 0.2640, 3.4804, 0.4724, 1.9387 and -1.9399, respectively which indicate that one unite change in the variable viz. education, Size of Family, occupation, land holding, Farming experience, Area under pulses crop, Cropping pattern, Sources of Irrigation, Annual Income, social participation, information seeking behaviour, Scientific orientation, economic motivation, innovativeness, and knowledge would affect -1.292, 2.4373, 0.0648, -3.8797, -1.3237, 0.9054, -0.4788, -0.6913, 0.0001, 6.4339, 0.2640, 3.4804, 0.4724, 1.9387 and -1.9399 unit change in socio-economic impact of red gram (BDN 711).

Table 2: Multiple regression analysis between of profile of red gram growers (BDN 711) with overall impact of red gram (BDN 711)

Sr. No.	Independent Variable	Regression coefficients (Bi)	Standard Error (S.E)	't' Value	P-value
1	Education	-1.2928	5.4301	-0.2381 ^{NS}	0.8120
2	Size of Family	2.4373	2.7130	0.8984 ^{NS}	0.3699
3	Occupation	0.0648	6.2311	0.0104 ^{NS}	0.9917
4	Land Holding	-3.8797	1.4336	-2.7062 ^{**}	0.0073
5	Farming experience	-1.3237	1.9301	-0.6858 ^{NS}	0.4936
6	Area under pulses crop	0.9054	2.8521	0.3175 ^{NS}	0.7512
7	Cropping pattern	-0.4788	0.6220	-0.7697 ^{NS}	0.4423
8	Sources of Irrigation	-0.6913	1.2642	-0.5468 ^{NS}	0.5851
9	Annual Income	0.0001	0.0001	2.1661 ^{**}	0.0314
10	Social Participation	6.4339	1.6260	3.9568 ^{**}	0.0001
11	Information seeking behaviour	0.2640	0.6164	0.4282 ^{NS}	0.6689
12	Scientific orientation	3.4804	2.6935	1.2921 ^{NS}	0.1976
13	Economic Motivation	0.4724	0.3593	1.3148 ^{NS}	0.1899
14	Innovativeness	1.9387	0.5545	3.4966 ^{**}	0.0006
15	Knowledge	-1.9399	2.4211	-0.8013 ^{NS}	0.4238

$R^2 = 0.2131$ Multiple R-value= 0.4617 F= 4.045 NS = Non- Significant

(* Significant at 0.05 level of probability ** Significant at 0.01 level of probability)

The result shows that the positive relationship between education of red gram BDN 711 growers. Therefore, annual income, social participation, innovativeness might establish positive and highly significant relationship with socio-economic impact of BDN 711 on farmers. Empirical relationships can be used, i.e., to determine yield vs. conditions, so process optimization can be achieved through better extension contact with farmers before starting and after season completion to reduce losses. There is also "multiple correlation," which is the correlation of multiple independent variables with a single dependent.

The similar findings of the result of Sharma *et al.* (2005)^[10], Wanole *et al.* (2018)^[14] and Nair (2021)^[13].

Conclusion

The coefficient of correlation analysis reveals that several factors significantly impact the socio-economic benefits derived from cultivating the red gram variety BDN 711. Education, family size, farming experience, social participation, information-seeking behavior, scientific orientation, economic motivation, innovativeness, and knowledge all exhibit positive and significant correlations with the socio-economic impact of this crop. In contrast, factors like occupation, land holding, area under pulse crops, cropping pattern, sources of irrigation, and annual

income show weaker or non-significant relationships. The multiple regression analysis further indicates that while the model explains 21.31% of the variation in socio-economic impact, other external factors likely contribute to the remaining variation. These findings underscore the importance of educational and behavioral factors in enhancing the benefits of red gram cultivation.

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Competing Interests

The authors declare that they had no competing interests.

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