



A DETAILED DESCRIPTIVE STUDY OF GRAM PRODUCTION IN PUNJAB, PAKISTAN

NIDA NASR^{1*} AND ABDUL QAYUUM²

¹Department of Statistics, G. C. University, Lahore, Pakistan.

²Department of Agriculture, Crop Reporting Service, Govt. of Punjab, Pakistan.

AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This paper is an effort to conduct a detailed descriptive study of Gram production in Punjab Pakistan. Gram is the most important pulse in Pakistan due to its cheap prices and high protein intake. In descriptive statistics impact of all the variables on the quantity of yield of crop has been examined. As a result many hidden dimensions are revealed.

Keywords: Gram; yield; crop; descriptive.

1. INTRODUCTION

In the economy of Pakistan agriculture plays a multidimensional role. It has a vital role ensuring food security, generating economic growth, providing employment, reducing poverty and earning foreign exchange. It contributes more than 21% to the Gross Domestic Product (GDP) and also generates employment opportunities to 45% of the total labor force. In rural areas almost 64% of population of Pakistan resides and earns their livelihood directly or indirectly from agricultural. It also provides raw material and market of industrial products to the industrial sector. Agriculture share is also very high in export earnings.

Pakistan's geographical area consists of 79.61 million hectares out of which the reported area is 57.05 million hectares, from which 39% area is cultivated which is 22.17 million hectares. The wasted area is almost 8.25 million hectares which could be used for

cultivation by improving resources like water availability. 20% of cultivated area is rainfed while 80% is irrigated by canals and tube wells etc. (Pakistan Bureau of Statistics). Punjab has three major seasons climatically hot (April to June), rainy (July to September) and cold (October to March).

Gram is a major Rabi crop of Pakistan, it is also known as chickpea, chana (*Cicer arietinum*). Ranking of Pakistan in term of acreage under cultivation of chickpea is 2nd. Pakistan's yield is very low w.r.t area as compared to many other countries, which is 581 kg *hectare*⁻¹ [1]. Gram is a short duration crop which is sown between September and November, but 1st week of October is best sowing time. After four months or a little later it reached to maturity in normal climate conditions. After reaching maturity rain and floods can be very harmful to the crop. It is also allergic to frost. It is a heat resistant crop and also entirely at the mercy of Mother Nature. Its long taproots manage water from deep inside the soil.

*Corresponding author: Email: nida.nasr@gmail.com;

There are two main types of gram:

1. Desi gram
2. Kabulli gram

Gram is very useful for digestion and control cholesterol if used in a normal quantity. It is also be used as medicine for snake bite, bronchitis, blood disorder, sun stroke and skin disease etc. For pains, cough and cold gram leaves are used.

1.1 Nutritional Quality of Gram and Its Health Benefits

In the developing countries, for millions of people gram is an important source of protein. Especially for those who are vegetarian either by choice or because of economic reasons. Because of high protein it is given the name as “poor man meat”. Protein range in gram is almost 17.63-24.7% [2]. It is also a good source of fiber, minerals, carbohydrates and β -carotene. One of the important thing is that it is cholesterol free.

Total carbohydrates of seed are from 52.4 to 70.9%. Range of soluble sugar is from 4.80 to 8.53%. Starch in gram is 20 to 30% and also fat ranges between 3.8 and 10.2%. Crude fiber's concentration is related to amount of seed coat, which ranges between 5.2 and 19.4%. 70% of the total seed calcium came from seed coat which is very important for the health of infants, children, pregnant women and lactating women in developing countries [3].

1.2 Statement of the Problem and Objective of the Study

By summarizing the whole problem in one statement it can be said that gram is the most nutritious food which can be equivalent to animal's meat. In developing countries like Pakistan poor man cannot afford meat to fulfil his nutrition, so the dependence of his nutrition will be pulses. In all the pulses gram is the most important one.

This study is an attempt to develop a model for projection of gram yield, which can further be used for any other crop. Building a model is the need of the hour which highlights all the factors that are effecting the production of gram crop. This is a cross-sectional study and the main focus of the study is to develop a model for yield. The data will be used of 2013 and 2014 of Gram producing districts of the Punjab, which is the most recent data.

Main objective of this study is to build up a detailed and informative descriptive study of gram crop in Punjab, Pakistan.

2. SOURCE OF DATA

Authenticity of results in any research work depends upon the accuracy of data. In this study secondary data will be used taking from Agriculture Department, Government of the Punjab. Purpose of the study was to estimate the yield of gram crop. For this purpose most recent data will be used.

2.1 Descriptive Statistics of Gram in Punjab

Descriptive statistics provides the summary of whole data to understand it. According to Table 1 average yield of gram crop in main districts of Punjab is 1.45 kg per plot (5.64 mund/acre). Fig. 1 shows the pattern of gram yield which shows slight positive skewness. As mean and median are almost equal we use mean as an average in further study.

Table 1. Descriptive statistics for the yield of gram in Punjab, Pakistan

Statistics	Estimate
Mean	1.46
Median	1.21
Mode	2.05
S.D	1.04

2.1.1 Year wise production

Data of two most recent years is used for this purpose. So year wise comparison in gram yield is calculated in Table 2.

Table 2. Year wise comparison of yield of gram

Variable	Yield of gram		
	N	Mean	C.V (%)
Year			
2013	546	1.64	70
2014	508	1.26	68

According to Table 2 average yield of gram is greater in 2013 than 2014. But variation in production is less in 2014 as compared to 2013.

2.1.2 Divisions

Data is collected from three divisions of Punjab in which gram crop is cultivated in bulk. Table 3 shows division wise comparison in gram yield.

Data is collected from three divisions Rawalpindi, Sargodha and Faisalabad. As the statistics shows in Table 3 Rawalpindi is at top position with 2.04 kg per plot (7.94 m/ac) yield and Sargodha is at bottom with 1.28 kg per plot (4.98 m/ac) yield. Faisalabad has shown the maximum variation production wise. Rawalpindi is the most consistent division with minimum variation.

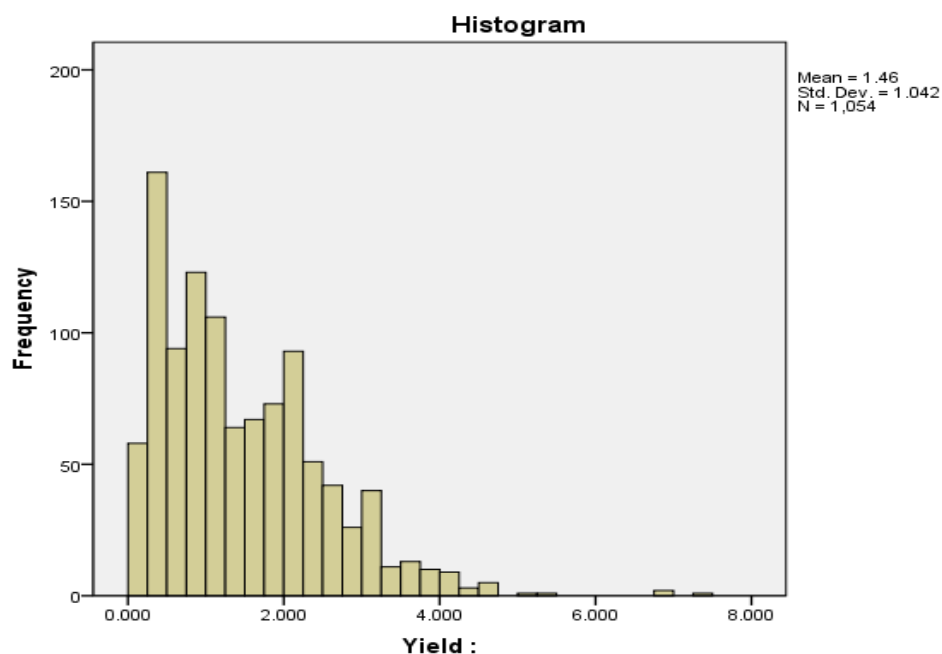


Fig. 1. Histogram of gram yield

Table 3. Division wise comparison of yield of gram

Variable	Yield of gram		
Divisions	N	Mean	C.V (%)
Rawalpindi	238	2.04	59
Sargodha	780	1.28	69
Faisalabad	36	1.40	107

2.1.3 Districts

Six districts are taken from Rawalpindi, Faisalabad and Sargodha. Table 4 shows the district wise comparison of gram yield.

Table 4 also shows district wise yield, in which T.T. Singh district of Faisalabad is at top position with 3.36 kg per plot (13.07 m/ac) yield. Chakwal district of Rawalpindi is at 2nd and Mianwali district of Sargodha is at 3rd position with 2.27 kg per plot (8.83 m/ac) and 2.17 kg per plot (8.44 m/ac) yield respectively. Bhakkar district has shown the maximum variation production wise and Jhang is the most consistent district with minimum 20% variation.

2.1.4 Seed type

There are two types of seed: One is home seed and second is certified. Table 5 shows the comparison of gram yield for both types.

Table 4. District wise comparison of yield of gram

Variable		Yield of gram	
Districts	N	Mean	C.V (%)
Attock	88	1.64	48
Bhakkar	402	.81	68
Chakwal	150	2.28	58
Khushab	282	1.65	50
Jhang	24	.42	20
T.T. Singh	12	3.37	27
Mianwali	96	2.17	45

Table 5. Comparison of gram yield for home/certified seed

Variable	Yield of gram		
Seed type	N	Mean	C.V (%)
Home	1012	1.44	72
Certified	42	1.83	42

According to statistics only 4% farmers use certified seed and 96% farmers use home seed. The average yield of gram using certified seed is greater than home seed and also more consistent with minimum variation in production.

2.1.5 Sowing style

There are two sow style: Broadcast and line. Comparison of gram yield is given in Table 6 according to sow style.

Table 6. Comparison of gram yield for broadcast/line sow style

Variable	Yield of gram		
	N	Mean	C.V (%)
Broadcast	130	2.18	61
Line	924	1.35	70

Most of the farmers prefer line style but by comparing with yield broadcast style is better than line style. Average yield of broadcast style is 2.18 kg per plot (8.48 m/ac) and 1.35 kg per plot (5.25 m/ac) is of line style.

2.1.6 Minour

Minour is used as common fertilizer for every crop. Comparison is made for those who used Minour and those who did not used Minour as fertilizer for the gram yield in Table 7.

Table 7. Comparison of yield of gram w.r.t usage of minour

Variable	Yield of gram		
	N	Mean	C.V (%)
No	1030	1.43	69
Yes	24	2.73	73

Those farmers who used gobber have maximum average yield than those who didn't. But very few farmers use gobber for their crop. Only 3% farmers used gobber according to Table 7.

2.1.7 Soil type

Three main types of soils are Lime, Sandy and Saltish-soil. Sandy type is mostly available and used for gram crop.

Average yield of gram is greater for Lime type as compared to Sandy and Saltish-soil. Saltish-soil is most difficult soil type for cultivation. Sandy type is the easiest for all the purposes and mostly available. 73% variation is shown for Sandy soil which is maximum w.r.t other two types.

Table 8. Comparison of yield of gram according to soil type

Variable	Yield of gram		
	N	Mean	C.V (%)
Lime	133	1.80	59
Sandy	921	1.41	73

2.2 Seed Treatment

Seed treatment is considered important for yield of any crop. Descriptive of seed treatment is given in Table 9 according to production of Gram crop.

Table 9. Treatment wise comparison of gram yield

Variable	Yield of gram		
	N	Mean	C.V (%)
Seed treatment			
No	1042	1.45	72
Yes	12	2.29	18

The average yield of gram is higher for those who receive seed treatment as compared to those who didn't.

2.2.1 Spray

Disease can affect the production at any stage and to prevent the crop from disease and insects spray is necessary. Table 10 shows the comparison for both spray on Gram yield.

Table 10. Comparison of yield of gram for spray

Variable	Yield of gram		
	N	Mean	C.V (%)
Spray			
No	1038	1.44	71
Yes	16	2.76	43

It shows that average yield of sprayed crop is higher than those who didn't receive any spray.

2.2.2 Irrigation mode

In Punjab there are two major classifications of area: irrigated and un-irrigated. Irrigated area is covered by canals, tube well and some other resources.

59% area is irrigated because of the availability of canal water, tube well and other mix sources. 41% of area is unirrigated which includes Rawalpindi and Sargodha divisions. Area irrigated by canal water has the higher average yield i.e. 1.89 kg per plot (7.35 m/ac). Un-irrigated area has the average yield of 1.77 kg per plot (6.88 m/ac).

Table 11. Comparison of gram yield w.r.t irrigation mode

Variable	Yield of gram		
	N	Mean	C.V (%)
Irrigation mode			
Canal	52	1.89	70
Tube well	73	1.10	36
Mix	494	1.19	76
Null	435	1.77	63

2.3 Number of Water Used to Gram Crop

Table 12 shows comparison of gram yield for different combinations of water and barani area.

Table 12. Comparison of yield of gram for different combinations of water

Variable		Yield of gram	
No. of water	N	Mean	C.V (%)
Barani	963	1.41	74
1	26	2.37	40
2	32	2.20	43
3	33	1.49	29

In irrigated areas number of water is very important for the yield of any crop but gram crop is mostly cultivated on Barani area. 91% area is reported as Barani and the average yield of gram crop under this area is 1.41 kg per plot (5.48 m/ac). Against 1-number of water average yield is maximum with 2.37 kg per plot (9.22 m/ac) with 40% variation.

2.4 Number of Ploughs Used to Gram Crop

Table 13 shows comparison of gram yield for different combinations of ploughs.

Table 13. Comparison of yield of gram for different combinations of ploughs

Variable		Yield of gram	
No. of plough	N	Mean	C.V (%)
2	729	1.29	70
3	243	1.68	65
4	66	2.18	60
5	10	3.77	16
6	6	.95	54

Number of plough in Punjab is from 2 to 6 for gram crop. Maximum average yield is gained 3.77 kg per plot (14.66 m/ac) in Punjab when 5 number of ploughs are used. Most farmers are used 2 number of ploughs with 1.29 kg per plot (5.02 m/ac) average yield with maximum variation of 70%.

2.5 Number of Levels Used to Gram Crop

Comparison is made for different combinations of levels w.r.t production in Table 14.

Number of level is from 0 to 4 in Punjab. Maximum average yield is gained with 2 levels. Min average yield is gained when 0 level is used. Most farmers use 1 level with 1.36 kg per plot (5.29 m/ac) average yield of gram crop.

Table 14. Comparison of yield of gram for different combinations of levels

Variable		Yield of gram	
Combination of levels	N	Mean	C.V (%)
0	80	1.05	68
1	746	1.36	69
2	202	1.99	65
3	26	1.37	68

2.6 Sowing Date and Production of Gram

Gram yield also depends upon sowing time. Table 15 shows the descriptive of Gram yield according to sowing date.

Table 15. Comparison of sowing time and gram yield

Variable		Yield of gram	
Sowing date	N	Mean	C.V (%)
Sep 1st half	20	.98	77
Sep 2nd half	57	1.36	57
Oct 1st half	538	1.45	71
Oct 2nd half	403	1.39	73
Nov 1st half	36	2.68	36

First half of September is not a good time for gram crop w.r.t its production. The best time for the gram crop is October first half and November first half to gain maximum yield. Most farmers preferred 1st half of October. It is observed by the statistics in Table 15 that after 15th September till 15th November gram crop should be sown to achieve the best results for yield.

2.7 Cut Date and Production of Gram

Comparison is made for different cut dates w.r.t production in Table 16.

Just like the sowing time the impact of cut date can be observed on the yield of gram. Cutting of gram is started from April to May, according to Table 16 best time for gram cutting is first half of May. Many farmers start cutting in first half of April which has the minimum average yield 1.16 kg per plot (4.51 m/ac) with maximum 76% variation in production.

Table 16. Comparison of cut date and gram yield

Variable		Yield of gram	
Cut date	N	Mean	C.V (%)
April 1st half	548	1.16	76
April 2nd half	308	1.68	61
May 1st half	198	1.94	60

2.8 Effect of Last Crop on Gram Production

Crop which is harvested before Gram crop is also important for its production. Comparison is made in Table 17 for Gram yield according to last crop.

Table 17. Comparison of yield of gram w.r.t last crop

Variable		Yield of gram	
Last crop	N	Mean	C.V (%)
Fallow	940	1.36	71
Others	114	2.27	55

Gram is mostly sown on fallow area with 1.36 kg per plot (5.29 m/ac) average yield.

2.9 Impact of Seed Quantity on Gram Yield

Impact of different quantities of seeds on gram yield is shown in Table 18.

Table 18. Comparison of yield of gram with different seed quantities

Variable		Yield of gram	
Seed quantity	N	Mean	C.V (%)
≤20	306	1.37	69
25	544	1.34	75
30	142	1.77	57
35	38	1.56	57
40	24	3.14	40

Quantity of seed is directly related to gram yield. By increasing the seed quantity gram yield also increased. Gram yield is maximum when 40 kg seed is used, it is minimum when less than 20 kg seed is used. Most farmers used 25 kg seed with average of 1.34 kg per plot (5.21 m/ac) yield.

3. CONCLUSION AND RECOMMENDATION

As it is discussed that Pakistan is an agricultural country and its economy is totally based on agriculture. The only way to save Pakistan's economy is to save its agriculture which can be possible by putting lots of effort in research work in this area and also implement all the findings to make the production better. A lot of institutes and universities are conducting this research and putting their efforts into this field. But there are still some area that are untouched. Statistics of agriculture is a little bit ignored despite the fact that a lot of departments are conducting this data in hard and soft form. Punjab Bureau of Statistics and Ministry of Agriculture and Livestock are putting their best efforts in this field. Crop Reporting Service, an attached wing of Agriculture Department, Government of The Punjab is also collecting data of crops since 1978. Sufficient data is available for researchers.

Data should be sufficient and climatic parameters have to be used for this purpose. Time should be an independent factor in these models. In production of any crop amount of rainfalls play an important role.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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