American-Eurasian J. Agric. & Environ. Sci., 14 (10): 1026-1029, 2014
ISSN 1818-6769

DOI: 10.5829/idosi.aejaes.2014.14.10.12427

Statistical Analysis of Agriculture Crop Data by Two Stage Systematic Sampling

Muhammad Akbar Ali Shah, Aneesa Yasmeen and Huma Qasim

Department of Statistics, The Islamia University of Bahawalpur, Pakistan

Abstract: This paper presents statistical analysis of agricultural crop data by Two Stage Systematic sampling (TSSS) scheme to check the variability of various crops in District Bahawalpur, Pakistan. Two Stage Systematic (TSS) sampling scheme is utilized to estimate the minimum variation in yield production. Precise results of crop-wise yields are obtained. Percent rate of change of the crops yield are calculated and comparison are made between the average yield production of District Bahawalpur across the years which indicates factors affecting the production wheat, rice, sugarcane, sunflower and mustard. The results show big variation with least production of mustard in 2007-08 which indicates unsuitable natural climatic factors and irregularity in irrigation schedule. The usage of low quality seed of sunflower crop is the main cause of low productivity. Bahawalpur has moderate temperature suitable for sugarcane crop. Main cause of variation in rice yield is the lack of Government cost & labor policies.

Key words: Two Stage Systematic Sampling (TSSS) · % change · District Bahawalpur · Wheat · Rice · Sugarcane · Sunflower · Mustard

INTRODUCTION

Crop development is important for the economic development of any nation. Different factors affect the growth of agricultural crops differently in different regions. Using Crop Reporting Service (CRS) data of main crops wheat, sugarcane, mustard, rice and sunflower different techniques have been made to check the variability of yield production like TSSS (Two Stage Systematic Sampling) technique. This technique is developed by Yu and Jin [1], they applied Two Stage Sampling in micro-architecture simulations and checked the precision of CPU components using simple random sampling, cluster sampling, systematic sampling and stratified sampling to find out high accuracy results without losing precision. First and Second Stages Systematic Sampling has been used to check the efficiency and accuracy of CPU components.

Al-Feel *et al*. [2] studied the different effects of plot size on the estimation of wheat yield 2009-2010 in New Halfa Scheme Sudan.

Hardke [3] reported the major factors affecting rice milling quality. These were plant diseases, insects, harvest moisture and air temperature effects. Mujere *et al*. [4] evaluated the influencing factors on irrigated wheat yield of Zimbabwe. Arshad *et al*. [5] worked on thirty seven sunflower hybrids which grown on RCBD with three replication in 2008 to estimate genetic parameters applying correlation coefficient, analysis of variance to compute the significant difference to study nature of hybrids.

Data: The secondary data of five main crops wheat, mustard, sunflower, sugarcane of 10 years (2001-11) for Bahawalpur District is collected from Crop Reporting Service Bahawalpur. The sampling unit's size for first and second stage of systematic sampling is determined. This sampling scheme is effective for the efficiency of above sampling scheme. In 2004 total number of villages has increased to 718 as compared to last three years. Data of wheat, sugarcane, mustard, rice and maize are collected through systematic sampling.

MATERIALS AND METHODS

A sample of 30 villages is selected by the following relationship.

Corresponding Author: Huma Qasim, Department of Statistics, The Islamia University of Bahawalpur, Pakistan.

In first stage

$$I = \frac{P}{n} \tag{1}$$

After 2003 population size is increased and sample of 38 villages is selected by the same technique.

where P is the total population and n is first stage unit size.

$$I_1 = \frac{S_1}{n_1} \tag{2}$$

where s_1= Ix In is the samples of first stage

$$S_2 = I \times In_1 \tag{3}$$

where I_1 is interval of second stage and In_1 is the number of selected unit size from S_2 (second stage). Let the mean of second stage systematic sampling is.

$$\bar{y}_i = \frac{1}{In_1}\sum_{j=1}^{n_1} y_{ij} \tag{4}$$

By Cochran [6] variance of two stage systematic sampling is

$$S_{2i}^2 = \frac{1}{In(In_1 - 1)}\sum_{i=1}^{n}\sum_{j=1}^{n_1}(y_{ij} - \bar{y}_i)^2 \tag{5}$$

The bias variance of two stage systematic sampling is.

Also

$$S_{2i}^2 = \frac{1}{In(In_1)}\sum_{i=1}^{n}\sum_{j=1}^{n_1}(y_{ij} - \bar{y}_i)^2 \tag{6}$$

The % rate of change is calculated by

$$\frac{b-a}{b}\times 100 \tag{7}$$

RESULTS

The analysis is restricted to Two Stage Systematic sampling due to economical constraints. Crop-wise second stage systematic variances of produce of Bahawalpur district across the years 2001-12 are estimated by equation (5) & (6) and are given in table below.

Table 1: Second-stage systematic sampling variances

Years/crops	Wheat	Rice	Mustard	Sunflower	Sugarcane
2001-02	13.74045	2.83	0.81	7.24	27517.88
2002-03	0.503681	30.51	0.95	10.26	12483.54
2003-04	0.416496	24.95	2.27	10.60	34064.55
2004-05	23.46	51.9	10.25	18.94	27644
2005-06	19.86	68.65	9.56	69.18	38992
2006-07	47.96	103.5	7.74	60.23	38509.5
2007-08	41.49	182.1	11.73	32.41	24247
2008-09	71.43	61.29	8.08	32.37	22110
2009-10	24.75	111.17	4.94	6.28	61413.7
2010-11	38.67	193.2	5.94	4.24	4512.1
2011-12	115.8	244.5	7.89	34.82	22529.1

DISCUSSION

Mustard crop having high variation in 2004-05 yield in Bahawalpur due to low quality seeds, pests attack on plants and shortage of canal water are the main reasons. But in next two years mustard seed has improvement in yield with low variation 9.56 and 7.73 respectively. Also shows big variation with least production in 2007-08 which indicates unsuitable natural climatic factors and irregularity in irrigation schedule. But in 2008-09 year mustard crop gives high yield with least variation 0.808. This may be due to good quality seeds and better use of fertilizers (Table & Fig. 1).

Sunflower crop has increased variation in 2005-06 as compared to preceding year. The reasons may be due to the low quality seeds, less area under cultivation, low prices as compared to last year and lack of improved technologies and resources in the area. Sunflower crop gives normal produce in 2009-10. But in the year 2010-11 sunflowers has good yield with reducing variation due to the improved price policies of Government and provide agricultural know how to farmers to enhance yield. (Table & Fig. 2). Sunflower percent change in yield has shown inconsistent behavior in 2001-10 because District Bahawalpur has unsuitable climate for growing of sunflower and down turn trend in 2004 and 2008-10 all over the Punjab. The usage of low quality seed of sunflower crop was the main cause of low productivity. (Table &Fig. 9).

Sugarcane shows maximum variation in 2009-10 due to minimum temperature in the area or farmers decreased sowing area due to less market price of crop. Main factor is that most area of sugarcane is occupied by wheat crop. Sugar mills behavior was the reason for low acreage. In 2007-08 sugarcane have sufficient output with least variation because Bahawalpur has moderate temperature suitable for sugarcane crop. (Table & Fig. 3).

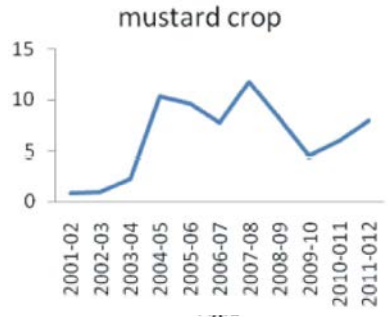

Fig. 1:

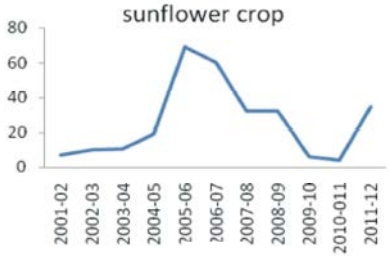

Fig. 2:

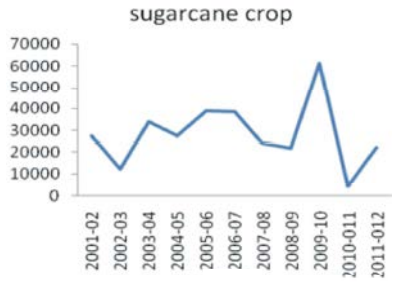

Fig. 3:

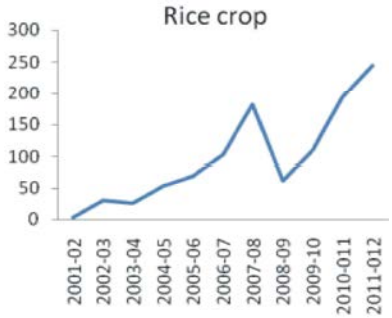

Fig. 4:

In 2011 there is maximum variation in the yield of rice crop caused by economical and social problems. Other affecting factors are heavy rains at harvesting time or hot weather at germination time, pests, no proper usage of fertilizers. Main cause of variation in rice yield is the lack of Government cost & labor policies. Rice crop yields minimum variation in 2001 the reasons may be good plants protection (Table & Fig. 4).

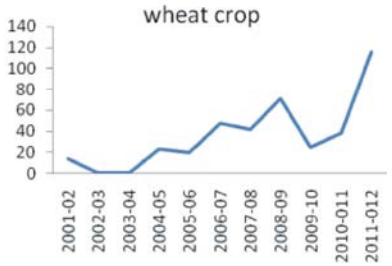

Fig. 5

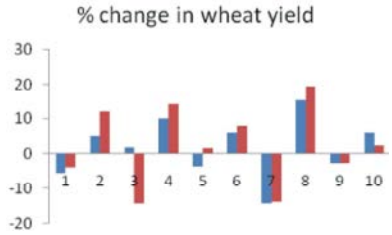

Fig. 6:

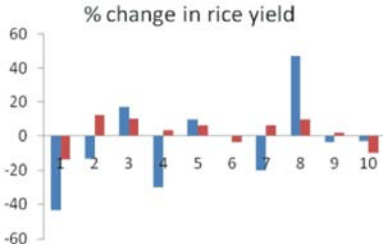

Fig. 7:

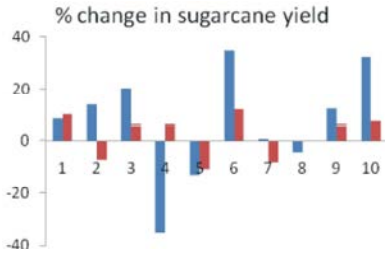

Fig. 8:

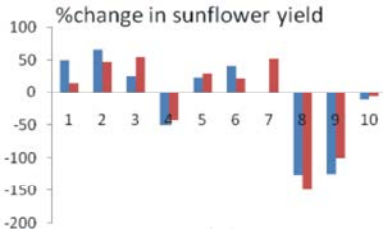

Fig. 9:

Wheat output showing least variation in 2002-03 due to normal temperature, good usage of fertilizers and adequate water availability, while maximum variation is found in 2011 due to pests and not availability of good quality seed (Table & Fig. 5) [7].

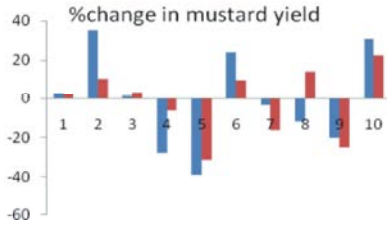

Fig. 10:

REFERENCES

1. Yu, Z. and H. Jin, 2007. TSS: Applying Two-Stage Systematic Sampling in Micro-Architecture Simulation, IEEE International Symposium, pp: 1-9.
2. Al-Feel, M., 2013. The Impact of Plot Size on the Estimation of Wheat Yield in Sudan: The case of New-Half Agriculture Scheme, Agricultural Economics Working Paper Series, Khartoum University. Working Paper No. 2.
3. Hardke, J., 2012. Factors affecting rice milling quality, Division of Agriculture Research and Extension, Rice Extension Agronomist, University of Arkansas, United States Department of Agriculture, Retrieved from http://www.uaex.edu.
4. Mujere, N., B. Chazovachii, G. Chifodya and A. Mushuku, 2011. Evaluating Factors Influencing the Variation of Irrigated Wheat Yields: A case study of Chinyamatumwa Irrigation Scheme in Zimbabwe, Journal of sustainable development in Africa, 13(4).
5. Arshad M., Khan, Jadoon and M. Akbers, 2010. Factor analysis in Sunflower (*Helianthus annuus* L.) to investigate desirable hybrids, Pak J. Bot., 42: 4393-4402.
6. Cochran, W.G., 1997. Sampling Techniques. 3rd Edition. John Wiley & Sons.
7. Yaseem, A., 2013. Application of two stage systematic sampling on agriculture crop production: A case study of Bahawalpur district. M. Phil Thesis. Department of Statistics, The Islamia University of Bahawalpur, Pakistan. & references therein.