Title of the Paper: Recent Experiences of Crop Cutting Experiments in Bangladesh for Annual Yield Estimation of rice

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Abstract

Bangladesh is predominantly an agrarian country. The geographical condition is favourable for growing vast quantity of different types of agricultural products. Rice is the most important agricultural product in consideration of coverage of area and production. The total production of rice was 3.38 million in 2012-13 FY. There are three seasonal rice. The internal consumption demand for rice is also high for more than 15 million population of the country. Agricultural production statistics is highly important for the government food policy including export and import. Bangladesh has long history to produce reliable agricultural statistics to the government, international organizations and all other stakeholders. As the supply and demand in the country is high, the government has to import rice when production falls due to natural calamities; the production situation goes under critical assessment. In view of critically analyse the production estimation procedure an instigated approach was undertaken by the government. Bangladesh Bureau of Statistics (BBS) under Statistics and Informatics Division (SID), Ministry of Planning produces annual agricultural production estimates as National Statistical Organization (NSO). Department of Agriculture

Extension (DAE) under Ministry of Agriculture prepares monitoring data in a subjective manner. Space Research and Remote Sensing organization, another government provides area estimates of two major rice. These three organizations with their concerned Ministries took part in the integrated assessment process.

Under the support of the Harmonization and Dissemination of Unified Production Statistics project which is going on with technical and financial support from Food and Agricultural Organization of the United Nations (FAO), BBS conducted 400 Crop Cutting Experiments (CCE) in two different districts. This was done with the joint participation of BBS and DAE officials using both crop cutting methodologies used by BBS (99.40 sq. feet) in a circular shape and DAE (20 sq. meter) in a rectangular shape. However, the statistical findings were that when the size of the crop cutting is smaller, higher the tendency of overestimation and the circle method provides less Coefficient of Variation (CV) due to less boundary.effect. These findings are supported by many experiments done earlier in India. It again upholds the idea that if the size of the plot of crop cutting is much lower than 170-180 sq. feet, there will be possibility of overestimation. And the circular cutting will provide less CV than the rectangular cutting having same plot size or cutting area. After critical analysis of the findings of the Experimental Crop Cutting the crop cutting plot size having 20 square meters (215.278 square feet) with circular shape was accepted. This will eliminate over or underestimation in one hand and less boundary effect as well as non-sampling error due to less perimeter (2.15 meter less) on the other hand. The minimum sample size (50 CCE) per

district is also determined and new crop cutting schedule and manual have been provided. A uni-stage sample design is followed and a ttotal of 10347 clusters are used as sampling frame (area frame) for selection of plot. The CCE of new methodology is being implemented jointly in the field level by BBS and DAE officials which has minimized the gap among stakeholders and increased the knowledge on estimation.

Key Words: BBS, SID, DAE, SPARRSO, NSO, CCE, UNFAO.

1. Background

Bangladesh is predominantly an agrarian country. The geographical condition is favourable for growing vast quantity of different types of agricultural products. Rice is the most important agricultural product in consideration of coverage of area and volume of production. The total production of rice in 2012-13 FY was 3.38 million m. tons. Bangladesh is the fourth largest rice producing country in the world. There are three seasonal rice in Bangladesh. The internal consumption demand for rice is also high for more than 15 million people of the country. Hence, agricultural production statistics is highly important for the food policy of the government including policies related to export and import. Bangladesh Bureau of Statistics (BBS) has a long history to provide reliable agricultural statistics to the government, international organizations and all other stakeholders. As the supply and demand in the country is high, the government has to import rice when production falls due to natural calamities. As a result, the production situation goes under critical assessment. Ministry of Food is to assess the requirement of food (rice and wheat)and to facilitate the government regarding availability

of food and to take export and import decision. BBS produces annual agricultural production estimates as National Statistical Organization (NSO) using the sampling methodology. DAE under Ministry of Agriculture prepares monitoring records in subjective manner and the Space Research and Remote Sensing Organization (SPARRSO), under Ministry of Defense provides area coverage of two major rice on the basis of satellite imageries. These data from different sources did not always match which created confusions to the stakeholders. To avoid this sort of confusions among government agencies a consensus among ministry of Planning, Ministry of Agriculture and Ministry of Food was made on the concept of harmonization. After that the Harmonization and Dissemination of Unified Agricultural Production Statistics (HDUAPS) project with the technical and financial support of Food and Agriculture Organization of the United Nations (UNFAO) was undertaken by the BBS. The national and international consultants of the project set activities to critically analyze the existing methodologies used by BBS, DAE and SPARRSO and organizations and recommended statistically sound methodology for yield estimation of rice. These three organizations with their concerned ministries associated with the integrated assessment process.

2. Methodology

Under the support of the HDUAPS project, BBS conducted 400 Crop (rice) Cutting Experiments (CCE) in two districts in the country. As it was decided by the Technical Committee of the project that as DAE has no sample design to select sample crop cutting plot, the plot selection can be done on the basis of the clusters (area estimates) formed and used by BBS for area and yield

estimation of crop. There were one hundred (100) crop cutting experiments using plot size 99.40 sq. feet with circular shape which was used in each district by BBS earlier and another 100 crop cutting conducted in the same plot using plot size 215.278 sq. feet (20 sq. meter) with rectangular shape which was used by DAE. As a result, a total of 200 CCEs were conducted in each district. More than 30 plots were fully harvested after conducting two CCEs. This gigantic task was done with the joint participation of BBS and DAE field officials. During field operations high officials from concerned agencies and ministries along with consultants visited field work to ensure quality of experiments.

3. Results Obtained

The data of 400 CCEs were analyzed and some extraordinary results were found which may be produced below:

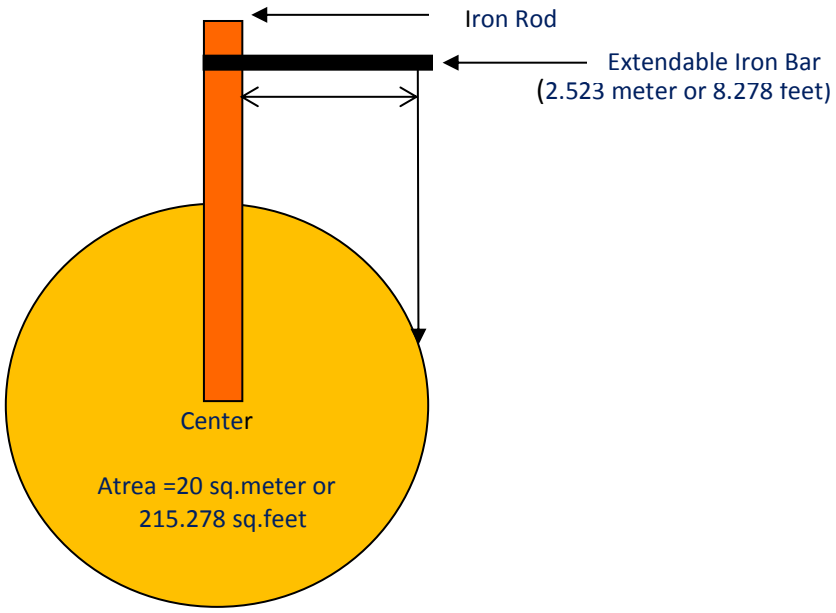
Table of Statistical Findings obtained from Crop (rice) Cutting Experiments

Name of Districts	Standard Error	Rectangular Shape (215.278 sq. feet earlier used by DAE)	Circular Shape (99.40 sq. feet earlier used by BBS)
Rajshahi District	Standard Error	44.61694	45.66414
	Coefficient of Variation	2.825875	2.793431
	% Over/underestimation	6.30741	10.6702
Barisal District	Standard Error	30.69389	30.92711
	Coefficient of Variation	2.970418	2.921049
	% Over/underestimation	- 2.352276	0.05259

In the table, it is evident that for both the shapes, overestimation is found only exception in Barisal district in case of rectangular shape. But it proves that smaller the size of the plot than 200 feet, the higher the tendency to produce overestimation. This result of investigation confirmed the previous experiments done earlier in India (Mahalanobis, 1945 and Sukhatme, 1947a). However, another important finding of these experiments is the circular shape provides less Coefficient of Variation (CV) in both the districts due to less boundary effect though the Standard error for rectangular shape is less. The result of this experiment also implies that the circular cutting will provide less CV than the rectangular cutting having same plot size or cutting area. This is because of less perimeter of circular plot than the rectangular plot. For example for 215 sq. feet plot area, the perimeter of circular shape will be 15.8533 meter and 18 meter for rectangular shape which is 2.1467 meter less. Due to less perimeter in same plot size, less will be the border effect as well as less non-sampling error. Consequently, it will provide less CV. After critical analysis of the findings of the Experimental Crop Cutting, the crop cutting plot size having 20 square meters (215.278 square feet) with circular shape was recommended by the project. The uni-stage sample design was recommended with sample size 50 Crop Cutting Experiments per district. Tin the country will be 50X64 district=3400 where as previously it was 10X487 upazila=4870. As a result cost will be minimized and the district wise level of precision will be also provided. This will eliminate over or underestimation. A total of 10347 clusters are used as sampling frame (area frame) for selection of plot. The CCE of new methodology is being implemented jointly in the field level since 2013 by BBS and DAE officials that has minimized the conflict on annual rice

production estimates and increased the knowledge users on estimation. The crop cutting instrument provided by the project can be graphically shown in the following way.

Graph of Experimental Crop (rice) Cutting Instrument



4. Conclusions

The necessity of statistically sound methodology for providing production estimates of rice is extensive in Bangladesh because of vast production and high internal demand. The consensus regarding this issue among the stakeholders is also very important for policy making. The new methodology was well discussed among stakeholders and they are aware about the estimation process, so there is no confusions of production estimates of rice. On the basis of new methodology, everybody will know the reliability of estimates. The data collection according to new methodology is being

implemented by BBS and DAE which can be considered the best practice among the ministries to work jointly and solve important national issues.

5. Success achieved and issues for further research

The production of rice in Bangladesh is high. So obtaining reliable data through the recommended methodology is really a great success of the project of the government of Bangladesh and FAO. The issue has been finally settled after large experiment done under the joint ownership and effort of the government and FAO. This example of joint activities among ministries can be followed and may solve many critical issues of the government which is concerned with more than one ministry. As there is many agricultural products grow abundantly in Bangladesh, this type of experiment can be done in the country for many other temporary and permanent crops.

6. Reference

Papers on Crop Cutting Experiments

By 1.Mahalanobis, 1945, and 2. Sukhatme, 1947a.