Review on Crop Cutting Experiments and Yield Assessment

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Introduction:-

Since 1944, Crop Cutting Experiments (CCE) are being used to asses crop yield.CCE has very much importance in crop insurance. Based on CCE Actual Yield of an area is calculated. If Actual yield is less than a pre-decided threshold yield, all the farmers in the respective area are supposed to have lesser yield. And such farmers are eligible for compensation.

Objectives of CCE's:-

- Revenue Mandal, Taluka, District level yield prediction of different crops.
- Producing data required for Paisewari Estimation.
- Collecting information regarding seeds, fertilizers, pesticides etc
- Collecting information for Crop insurance

CCE's also have an important role in computing Paisewari of a chosen village (Gram Panchayat). As per Government resolution[4] dated on 03 Nov 2015, the average of the production of the last 5 years is calculated. The ratio of this value with gram panchayat current yield is computed. Further, this ratio is used along with Mahsul Village wise CCE area fora weighted average. If this weighted average is less than 0.50 then gram panchayat will be declared as drought affected. It is also mentioned in [4] that it is required to conduct at least 6 crop cutting experiments for each primary crop in a Gram Panchayat.

Above mentioned are two applications of CCE. Number of samples to be conducted as per PMFBY[3] and CCE Manual[2]

Chosen Village:-4, Every Mandal:- 10, Every Taluka:-16, Every District:-24.

At district level training, village selection for CCE's is done based on temporary villages selected. Three Departments Revenue, Zilha Parishad and Agriculture are involved in Crop Cutting Experiment. Once a village is selected, Gramsevak, Talathi and Agri assistant are primary individuals conducting the CCE's.On the day of harvest, they have to send one copy of Form II to their offices, viz. Tahsildar, BDO, Taluka Agricultural officer.

CCE has to be done in supervision and presence of Village Level Committee (VLC). Sarpanch, Police Patil, Gramsevak and Talathi are the members of VLC. The VLC is headed by Mandal Agri. Officer(in case of the experiment is being conducted by Agri. Department), Mandal officer(in case of the experiment is being conducted by the Revenue Department), and Agri. the officer in case the experiment is being conducted by Block Division).

If the selected village does not have at least two survey number of the chosen (experimental) crop, then "No Crop" report has to produced by field officers(Talathi, Krushi Sahayyak, Gramsevak). and a request for changing the village has to be made. In the case of Zero productivity, VLC has to report this as Zero Production".

Sr.No	Season		Primary Crops
1.	Kharif	Primary Crop	Rice(Irrigated),Rice(Non-Irrigated),Kharif Jawari,Bajra,Raagi,Cotton,Sugarcane,Groundnut,Tambakhu
		Secondary Crops	Tur, Til, Jawas, Khurasani, Mung, Udid, Soybean, Maize, Sunflower
		Horticulture	Kharif Onion
2.	Rabi	Primary Crop	Rabi-Jawari(irrigated), RabiJawari(Non-Irrigated), Wheat(Irrigated), Wheat(Non-Irrigated), Chickpea, Maize Sunflower, Karzai
		Horticulture	Rabi Onion
3.	Summer	Primary	Summer Groundnut, Summer Rice, Summer Sunflower

Table 1 Crops covered in CCE

While planning CCE's size of field plot is also important. Table 2 below shows the plot size for different crops.

Sr.No	Crop Name	Plot Size (in Meter)
1.	Rice,Bajari,Kharif-Jawari,Ground nut,Til,jawas,Rabbi Jawari,Wheat,Chickpea,Kardai,Summer Rice,Summer Sunflower,summer Ground nut	10 M x 10 M
2.	Cotton,Tur	20M x 10 M
3.	Mungbean,Udid,Soyabean,Nachani	10M x 5M
4.	Sugarcane, Onion	5M x5M

Table 2 CCE Experimetnal Plot Measurements

Data Collected in CCE:- Three informative forms are filled during CCE Experiment.
Form 1 is used for marking of the crop. Form II is for recording crop yield. Form III also describes harvesting details. Table 3 below describes the timeline for submission of these forms.

Form No	Kharif	Rabi	Summer
I	25 August	15 December	15 March
II	Immediately after harvesting	Immediately after harvesting	Immediately after harvesting
III	After Drying	After Drying	After Drying

Table 3 deadline for submission of Form I, II, III

The table below describes Data collected while conducting CCE's.

Data Level	Data	Details of Data
Form I	Soil Type	Good, Medium, Bad
	Fertilizer Application	Type and Quanitity
	Seeds	Seed name,Quanitity,Place of purchase
	Summary of crop growth	Crop growth(good/Medium/Bad) Water logging in farm? Rain(Satisfactory/Unsatisfactory/very high/flood/hail) weeding
	Crop Damage	Crop damage due to animal attack
	Watering	Source,No.of Waterings,Day's in between two watering
	Pesticide Applications	
	Loan	Whether Farmer has taken loan for crop in which CCE being conducted? Amount,Date,Area,Source
	yield prediction by eyesight	Quintal/Ha
Form II	Fertilizer Application	Type and Quanitity
	Pesticide Application	Name,No. of applications,Quantitiy
	Weighing Details	Crop weight, crop residue
	Laboring Details	Genderwise number, charges
	Intercropping Details	Percentage of intercropping,No. of lines of other crop and experimental crop
	Harvesting Details	Whether crop has been damaged? Changed in date of harvest, Change in yield prediction from Form I with reasons,
	CCE Supervision Details	Crop Stage, Officer's Details
Form III	Weighing deatils	Date of Harvest

		Weight at time of Harvest,Bag Weight
		Weights until crop dry wet gets constant
		Final Non Changing dry weight

Methodologies in CCE:- In CCE design three levels of randomization occurs. Based on this Village Selection, Survey/Gat Number Selection, Pot Hissa Selection(Within Gat Number Selection of Farm), Farm Area Selection is done. Below mentioned are the methodologies involved in CCE.

1. Village Selection:-
   - T.R.A (Timely reporting of Sowing Area) Goshwara is completely dependent on Pik Pahani.
   - 20% of Villages from the total number of villages in Mandal are selected under T.R.A Randomly
   - Talathi has to prepare T.R.A Goshwara Form for villages by visiting each survey number in village.
   - Temporary Village Selection:-
     - Each village in Mandal has to be selected at least once in 5 years.
     - Last year cropping pattern from concerned departments is also used for this
     - Based on the list received from Mandal while District level training Final Village selection is performed.
   - Final Village Selection:-
     - On the day of training, Talathi, Agri Dept Officers selects final Villages based on temporary village list.

2. Survey/Gat Number Selection:-

   Method A:-

   a. List the survey numbers for the selected crop in CCE Experiment Village
   b. Arrange Survey numbers in ascending order. Assign Serial number for this ascending order.
   c. Select Random Number from Random Number Table for the assigned column number.
   d. Selection of digits of Random Number:-
      1. Based on a number of digits in the maximum serial number(which is derived from arranging survey numbers in ascending order) we have to select that much number of digits in Random Number.
      2. If Serial number is of two digits then consider left most Two digits of Random Number. If Serial Number is of 3 digits then consider three digits of a random number, And so on.

3. Now New Number formed (based on No. of digits in random number and ignoring rest digits) will be used to select Survey Number for CCE Experiment.

e. Survey number corresponding to the serial number(which is number formed from random number) is selected for CCE

f. Example:-

1. Suppose we have 43 Survey numbers. And those are ordered in ascending order so that each survey number have a unique serial number (Max. up to 43).
2. Next step is to getting Random number for Survey selection. Suppose the village has been assigned with column no.1.Then the corresponding random number will be 3893.
3. Selection of Digits;- As serial number if of only two digits. Only two leftmost digits of the random number will be considered rest will be ignored. Our scenario selection will only 38.
4. Now survey number corresponding to Serial 38 will be our Survey number for CCE for a particular crop.

Method B:-

- Method B will be selected when a number of Survey Numbers are greater than 200 and Village Pik pahani could not be completed.
- Then list all Survey Numbers, and Pot numbers too
- Assign a serial number to this list.
- Follow Method A for further process.
- If the crop is unavailable for computed survey number then repeat Method A until the required survey number is found.

3. Pot Hissa Selection(Within Gat Number Selection of Farm)
   a. List all Pot his (Within Gat No.) having the same crop of CCE
   b. Assign serial number for each Pot his. For numbering, Go West to East and South to North.
   c. Use Method A for randomization.
   d. Compute number for Pot Hissa
4. Farm Area Selection(Selecting required part of Farm)
   a. If Selected Plot has Crop with Broadcasting sowing Method
      1. Select North West Corner. Watching at South Direction Right Side of the farm will be length. And Side at straight hand to the south is Width
      2. Subtract Experimental plot Length from actual plot Length. And Select Random Number for it.
      3. Get Random length from this Random Number

4. Subtract Experimental plot Width from actual plot Width. And Select Random Number for it.
5. Get Random width from this Random Number
6. Use this Random Width and Length dimensions to get North West bottom point of CCE plot

b. If Selected Plot has Crop with Line sowing Method

1. Select North West Corner.
2. If lines are in East-West direction, then count lines from north to south. If lines are in North-South direction then count lines east to west.
3. Count Number of lines with 5/10 meter distance. Subtract one from it.
4. subtract this reminder from a total number of lines.
5. Select a random number based on step 4 subtraction. And choose the respective random line.
6. Measure the length of the line and subtract it from the actual plot length.
7. Select random number based on a reminder from step 6
8. Use this Random Width and Length dimensions to get North West bottom point of CCE plot

CCE's in scenario of PoCRA Village Productivity Assessment:-

- Data available at government official website is State, District and taluka level with only values of Yield in Kg/Ha [1].
- CCE's are designed so as to cover each village once in 5 years.
- CCE's are designed completely randomized approach at three levels 1.Village 2. Survey Number 3. Farm Selection. So it very clear that selection of the same farmer is nearly impossible at least not in 5 years.
- Village level changes in crop productivity due to new water conservation and storage cannot be assessed. Because Village level CCE reports are not publicly displayed.
- Though very detailed questions are covered in Form 1, Form 2 and Form 3 like Number of watering, fertilizers there is no inclusion in actual calculations of Yield.
- A number of CCE's conducted are most likely minimum number according to guidelines[5]. Another hand, an increasing number of CCE's in some states led to a burden on field agencies and further deterioration in data quality.
- In report no.7,2017 CAG[6] mentioned low supervision of CCE's in three districts of Maharashtra. Further, questioned that *it is not clear how it was ensured that the CCE's were conducted properly*.
- including irrigated and non irrigated fields with AET and getting values of productivity in kg/m^3 has to be the next step.

Unclear Questions from CCE Literature:-

- Survey numbers, Plot and Pothissa are selected randomly based on the random number from particular Column assigned to the village. From literature, it is very unclear that on what basis these columns are assigned to villages.
- manual[2] point 20.6 explains about wet grains. Which clearly mentions that, if the grain is wet then it has to dry for a single day. But In Form III It is clearly mentioned that Crop has to dry for six days until there is no change in the last two weights. So there is confusion about dry weight about drying.
- Also, it is very unclear, how the crop will be taken care if it has to dry for more than a single day? What about the storage of harvested crop? And its responsibility.
- is Irrigated (Bagayati) and Non irrigated(Jirayati) farm primarily based on irrigation source availability? How much water available from the source is of not any consideration? Suppose a Farm has a source of well. And actual rainfall is less than required. Farm selected at the time was irrigated but the time of harvesting it will be considered as Non-Irrigated or Irrigated.
- CCE distinguishes crop Wheat Jawari as Irrigated and Non irrigated, But not other crops like Chickpea.
- As per Forms I, II, III Single CCE is equivalent to two field plots(of two different Farmers)

References:-

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