



E-ISSN: 2278-4136

P-ISSN: 2349-8234

www.phytojournal.com

JPP 2020; Sp-9(4): 138-145

Received: 15-06-2020

Accepted: 10-07-2020

P Lavanya Kumari

Assistant Professor, Department of Statistics and Computer Applications, S.V. Agricultural College, ANGRAU, Tirupati, Andhra Pradesh, India

G Krishna Reddy

Principal Scientist, Department of Agronomy, Regional Agricultural Research Station, ANGRAU, Tirupati, Andhra Pradesh, India

ANGRAU Fertilizer Planner-2015 (AFP-15)

P Lavanya Kumari and G Krishna Reddy

Abstract

In the present day of modern agriculture, the use of fertilizers or pesticides are considered the most important yield attributing factors normally followed by the farming community. Usually, the dosage of fertilisers will be applied as per respective University recommendations provided for each micronutrient crop wise. But, complex fertilisers are widely available in the market for which some computation, mechanism is required to fix the correct quantity to meet the said University commendations. Due to intricacy involved in calculation, most of the farmers apply fertilizers approximately that leads to either under or over dosage of fertilisers. This result either in lower yield or deterioration of soil health. To overcome this problem authors have developed a user-friendly MS-Excel based Fertiliser Planner as a quick Decision Support System (DSS). It serves nearly 167 individual crops or crop stages and one can easily understand the methodology used. Further updation can be made with respect to crops, quantities and prices etc., within no time.

Keywords: Fertiliser Planner, University recommendations, MS Excel, Decision Support System

1. Introduction

All over the world, the use of fertilizers or pesticides are considered the most important yield attributing factors normally followed by the farming community in the present day of modern agriculture. This is an attractive method of increasing their productivity by way of chemical fertilizers as well as use of pesticides for controlling pests. Presently, climate change makes the application of fertilizers and pesticides are inevitable. But most of the farmers are using them extensively than recommended doses due to misconceptions and lack of proper awareness on them. State Agricultural Universities have been suggesting the exact recommendations for each crop by their concrete, continuous research efforts.

2. Negative effects of over dosage of fertilizers

If fertilizers are not used as per the university recommendations, there is every possibility of arising two important situations like low dose situation another is high/excess/ over/ indiscriminate dose situation. In the first situation the desired effect on crop growth and yield could not be achieved. Second situation of applying overdose of recommended dose results in various losses *viz.*, the unused nutrients may run off from soil and enter into water supplies and contaminate the groundwater. Secondly the plants may be affected or killed if the fertilizer dose is too high. Plants can also suffer from fertilizer burning under excess application. Plants cannot absorb required nutrients from soil supplied with excess fertilizer because of damage of their root system and also can leach into water system. When excess nitrogen and phosphorus reaches ponds and streams, they create a problem known as eutrophication. Eutrophication causes overgrowth of algae, which depletes oxygen, killing of fish and other aquatic life. A byproduct of chemical fertilizers is nitrous oxide -- a hazardous greenhouse gas that contributes to climate change and destroys ozone layer also. Nitrous oxide production can be minimized by not applying excess fertilizer doses. Hence, the higher dosage of fertilizers and use of unnecessary supplements is a cause of concern as it is leading to the deterioration of soil health besides hitting the farm economy and also enhances the cost of production.

3. About Recommendations

Generally, recommendations for any crop will be in the form of micronutrients *viz.*, Nitrogen (N), Phosphorous (P) and Potassium (K) in kilograms per acre of land. These nutrients will be available in the form of straight fertilizers *viz.*, Urea, SSP and MOP respectively, usually in 50 kg bags. But these 50 kg bags contain only 23, 8 and 30 kg of N, P and K respectively. For explanation purpose let us assume a groundnut crop to be grown during *Rabi* season and recommended macro nutrients are 12, 16, and 20kgs per acre respectively. Prices of one kg of Urea, SSP and MOP are Rs. 5.6, Rs. 7.6 and Rs. 16.8 respectively.

Corresponding Author:**P Lavanya Kumari**

Assistant Professor, Department of Statistics and Computer Applications, S.V. Agricultural College, ANGRAU, Tirupati, Andhra Pradesh, India

4. Cost calculation for Straight (individual) Fertilisers (Urea, SSP and MOP)

- 4.1 Hence the required quantity of Urea will be $(\frac{50}{23} \times 12 = 26)$ 26 kgs/acre, SSP will be $(\frac{50}{8} \times 16 = 100)$ 100 kg/acre and MOP will be $(\frac{50}{30} \times 20 = 33.3)$ 33 kg/acre.
- 4.2 Otherwise the recommendations will be directly multiplied with the nutrient quotients to get required Urea, SSP and MOP per acre of land.
- 4.3 Nutrient coefficients will be computed as (Weight of the Urea bag/available N), (Weight of the SSP bag/available P) and (Weight of the MOP bag/available K). Actual N content in a 50 kg of Urea bag is 23 kg actual P content in a 50kg of SSP bag is 8 kg and actual K content in a 50kg of MOP bag is 30 kg. Hence, the nutrient coefficients will be (50/23, 50/8 and 50/30) i.e 2.1739, 6.25 and 1.6667 respectively.
- 4.4 If the recommended major nutrients are 12.6 and 20 and the required Urea, SSP and MOP per acre will be $(12 \times 2.1739 = 26)$ 26 kg/acre, $(16 \times 6.25 = 100)$ 100 kg/acre and $(20 \times 1.6667 = 33.33)$ 33kg/acre.
- 4.5 The total cost incurred for straight fertilizers will be (required quantity of Urea/acre X cost of Urea/kg) + (required quantity of SSP/acre X cost of SSP/kg) + (required quantity of MOP/acre X cost of MOP/kg).
- 4.6 Total cost with straight fertilizer = $(26 \times 5.6) + (100 \times 7.6) + (33 \times 16.8) = \text{Rs. } 1460/\text{acre}$.

5. Situation opting for Complex Fertilisers

Scientists always suggest the farming community to use straight fertilizers only to prevent extra cost burden incurred with complex fertilizers. But most of the farmers choose complex fertilizers due to non-availability of Urea, SSP and MOP in the required quantities or on the advice of sellers who have vested interests. Fixing up the quantities of complexes is quite tricky and is not easy as that of straight fertilizers as mentioned above. *The major objective is that any nutrient should not be applied more than recommended dose.* Hence, one cannot fix any nutrient coefficients in this case as straight fertilizers as explained above.

6. Cost calculation for Complex Fertilisers

For the same crop (Groundnut-Rabi), if the farmer chooses a complex 12-32-16 of having price Rs 22.6 per kg, then the computations for required quantity are shown below.

- 6.1 Identify the nutrient which has minimum availability because no nutrient will be supplied beyond the recommendations. In our example that is Nitrogen with 12 kg.
- 6.2 Compute the ratios viz., (Recommended N/available N in the selected complex, (Recommended P/available P in the selected complex) and (Recommended K/available K in the selected complex). For example, presently these ratios will be (12/12), (16/32) and (20/16) which means 1, 0.5, and 1.3 respectively.
- 6.3 Select minimum ratio among them, i.e 0.5. The maximum quantity of select complex will be obtained by multiplying the minimum ratio with 100 i.e $(0.5 \times 100 = 50)$ 50 kg.
- 6.4 Up to this stage recommendations met are (available N x min ratio), (available P x min ratio) and (available K x min ratio). In our example, with 50kg of complex we can meet $(12 \times 0.5 = 6)$ 6 kg of N, $(32 \times 0.5 = 16)$ 16 kg of P and $(16 \times 0.5 = 8)$ 8 kg of K. But we are lagged with 6 kg

of N and 12 kg of K since recommended doses are 12, 16 and 20 respectively.

- 6.5 Then compute the straight nutrients such as Urea, SSP and MOP to meet the recommended doses on N, P and K using the following formula.
- 6.6 (Lagged N x coefficient of N), (Lagged P x coefficient of P) and (Lagged K x coefficient of K). In our example, $(6 \times 2.1739 = 13.02) \approx 13$ kgs of Urea, $(0 \times 6.25 = 0)$ 0 kg of SSP and $(12 \times 1.6667 = 20)$ 20 kgs of MOP.
- 6.7 Hence, 50kgs of complex (12-32-16), 13 kg of Urea and 20kg of MOP are required to meet the recommended doses exactly for groundnut in an acre of land during *Rabi*.
- 6.8 Total fertiliser cost incurred in cultivating groundnut crop during *Rabi* season will be (required complex x cost of complex/kg) + (required Urea/acre x cost of Urea/kg) + (required SSP/acre x cost of SSP/kg) + (required MOP/acre x cost of MOP/kg).
- 6.9 Total cost with complex (12-32-16) = $50 \times 22.26 + 13 \times 5.6 + 20 \times 16.8 = \text{Rs. } 1522/\text{acre}$.

7. Need for Computer Assisted Programme

Fertiliser cost computation procedures explained in Section-4 and Section-6 can be followed by any person with little bit of mathematical knowledge and patience. Whereas these procedures will not provide an overall picture about the costs incurred with various complexes at a time. If one wishes to know the cost of fertilisers for other crops or for other complexes, one has to repeat these procedures once again which leads fatigue and causes to errors.

8. Justification for the present invention

To overcome the difficulty in cost computations explained in Section-7, many programmes/software/modules are available in internet which either have long procedure (multi folded) or failed in providing overall picture based on many complexes at a time. Further some programmes need special installations or higher-level specifications in computer. Hence, there is a great need to provide a mechanism which automatizes the tedious computations in getting cost of fertilisers for several crops and various complexes instantly. In this connection, a group of inventors had a thought to develop a programme in MS-Excel, which is available in almost all computers instead of purchasing high level software for this purpose. Their plans came into existence in the form of a user friendly programme in MS-Excel using built-in functions of various types and named the programme as ANGRAU Fertiliser Planner-2015 (AFP-15).

This entire programme is designed in Excel file which has two sheets namely '*Planner*' and '*Crops*'. One can view the list of crops in the sheet '*Crops*' for which '*Planner*' has been designed.

9. Features of ANGRAU Fertiliser Planner-2015 (AFP-15)

This programme will become user-friendly with its unique features mentioned below.

- 9.1 It avoids manual computations which takes more time and even fails to obtain overall picture on cost of fertilisers.
- 9.2 It displays university recommendations automatically based on crop and no need to remember and feed them manually.
- 9.3 It converts recommended doses available in the form of N, P and K into Urea, SSP and MOP automatically.

- 9.4. Costs can be obtained for both straight fertilisers and for 12 complex fertilisers at a time.
- 9.5 It is designed for 167 crops/crop stages (Food crops: 45, Fruit crops: 80 and Vegetable crops: 42). It is very flexible for no.of crops that means at any time one can include or exclude the crops.
- 9.6 It allows the changes in recommended doses (if any) very quickly and acts according to new values.
- 9.7 It accepts the changes in cost of the fertilisers (if any) and considers the same immediately.
- 9.8 Finally, it can be downloaded to any PC which has Windows Operating System and MS-Office not lower than Office-2007 version.

10. Working procedure (inputs) for the ANGRAU Fertilizer Planner- 2015 (AFP-15)

1. Download the Excel file.
2. Select the sheet 'Crops' to view the list of crops available.
3. Then go to sheet 'Planner' and select the desired crop from the drop down list in A3 cell.
4. Enter the area in acres or no.of plants (if fruit crops) in the cell A5.

Example: If a farmer has 2 acres and 25 cents of land then the entry will be 2.25. If a farmer has 20 trees then the entry will be 20.

11. Output to be obtained

ANGRAU Fertiliser Planner -2015 (AFP-15) will provide the following.

1. It provides recommendations based on selected crop in the form of N, P, K.
2. It provides the required quantities of Urea, SSP and MOP (in kg) based on selected crop as per the area of land given.
3. It discloses the fertiliser cost incurred to cultivate the selected crop in the given area of land/no. of plants for straight fertilisers (Urea, SSP and MOP).

4. And it also displays the costs of fertilisers for 12 complexes at a time for selected crop, which leads to plan in a better way.
5. It warns for unnecessary supplements provided beyond recommendations due to selection of complex fertilisers with negative values.
6. It highlights and disclosed separately the complex or straight which provides minimum cost for selected crop in the given area of land/no. of plants.
7. One can get entire output for another crop within no time. Likewise the cost incurred for several crops at various complexes can be viewed easily.

Note: If area is not given it provides requirements and costs incurred per acre of land or single plant (for fruit crops).

12. Advantages of ANGRAU Fertiliser Planner-2015 (AFP-15)

1. It avoids the practice of approximate and excess utilization of fertilisers so that soil health can be protected.
2. It avoids the dependency on sellers who sometimes misguides the farmers for selection of complexes.
3. It avoids the dependency of decision maker on other persons/officers for computations and conversions.
4. It enhances the vision of the farmer to reduce the unnecessary cost of cultivation in terms of fertilisers.
5. It allows the decision maker to take printed form of output by single click.

13. Recommendation

Finally we recommend that always use latest version of Fertiliser Planner which is updated for new prices and new doses of nutrients.

It protects soil health & saves farmer's money

14. Programme code used in designing the ANGRAU Fertiliser Planner -2015 (AFP-15)

Sl. No	Cell address	Programme code used (in sheet 'Planner')	Remarks
1	A1:H1	ANGRAU Fertiliser Planner 2015 (AFP-15)	Title
2	A2	Enter Name of the Crop	
3	D2	N (kgs)	
4	E2	P (kgs)	
5	F2	K (kgs)	
6	A3	Dropdown list of field (45), fruit(80) and vegetables crops(42)-total(167)	INPUT
7	B3	Dropdown symbol	Symbol
8	C3	=IFERROR((CONCATENATE("Recommended dose/ ",VLOOKUP(A3,J84:P251,7,0))),"")	Provides recommendations per acre or per plant
9	D3	=IFERROR(IF(A3="Crop","",(VLOOKUP(A3,J84:P251,2,0))),"")	
10	E3	=IFERROR(IF(A3="Crop","",(VLOOKUP(A3,J84:P251,3,0))),"")	
11	F3	=IFERROR(IF(A3="Crop","",(VLOOKUP(A3,J84:P251,4,0))),"")	Title according to crop and area / no.of plants
12	G2:H3	=IFERROR(IF(A3="Crop","",(CONCATENATE("Total Minimum cost (Rs.) for ",A5," ",VLOOKUP(A3,J84:P251,7,0),"(s)"))),"")	
13	A4	Enter Area of Crop in acres (OR) No.of Plants	Title for input of area
14	C4	=IFERROR(CONCATENATE("Recommended dose for your area (" ,A5,") ",VLOOKUP(A3,J84:P251,7,0),"s"),"")	Provides recommendations as per the area or no.of plant entered
15	D4	=IFERROR(IF(A5=0,(D3*1),(D3*\$A\$5)),"")	
16	E4	=IFERROR(IF(A5=0,(E3*1),(E3*\$A\$5)),"")	
17	F4	=IFERROR(IF(A5=0,(F3*1),(F3*\$A\$5)),"")	
18	G4:H4	=IFERROR((MIN(H12:H36)),0)	Provides the minimum cost among all complexes including Straight fertiliser
19	A5	Blank to receive area/no.of plants	INPUT
20	A9:H9	Required Fertiliser Dose as per Recommendations	Title

21	A10:A11	Complex Fertilisers	
22	C10:C11	Complex Price(Rs/kg)	Price of complex fertiliser (Rs/kg)
23	D10	UREA	Title
24	E10	SSP	
25	F10	MOP	
26	G10	Complex	
27	H10	Total Cost	
28	D11	=IFERROR(IF(A3="Crop", ",(CONCATENATE(VLOOKUP(A3,J84:P251,5,0),"", A5,VLOOKUP(A3,J84:P251,7,0),"(s)")))," ")	
29	E11	=IFERROR(IF(A3="Crop", ",(CONCATENATE(VLOOKUP(A3,J84:P251,5,0),"", A5,VLOOKUP(A3,J84:P251,7,0),"(s)")))," ")	
30	F11	=IFERROR(IF(A3="Crop", ",(CONCATENATE(VLOOKUP(A3,J84:P251,5,0),"", A5,VLOOKUP(A3,J84:P251,7,0),"(s)")))," ")	
31	G11	=IFERROR(IF(A3="Crop", ",(CONCATENATE(VLOOKUP(A3,J84:P251,5,0),"", A5,VLOOKUP(A3,J84:P251,7,0),"(s)")))," ")	
32	H11	=IFERROR(IF(A3="Crop", ",(CONCATENATE(VLOOKUP(A3,J84:P251,6,0),"", A5,VLOOKUP(A3,J84:P251,7,0),"(s)")))," ")	
33	A12	Straight Fertiliser	Titles
34	A14	DAP(18-46-0)	
35	A16	15-15-15	
36	A18	15-15-15(B)	
37	A20	20-20-0	
38	A22	20-20-0-13	
39	A24	16-20-0-13	
40	A26	10-26--26	
41	A28	12-32-16	
42	A30	14-28-14	
43	A32	14-35-14	
44	A34	17-17-17	
45	A36	28-28-0	
46	C12	-	
47	C14	=VLOOKUP(\$A14,J67:O79,2,0)	Retrieves the prices of various fertilisers per kg
48	C16	=VLOOKUP(\$A16,J67:O79,2,0)	
49	C18	=VLOOKUP(\$A18,J67:O79,2,0)	
50	C20	=VLOOKUP(\$A20,J67:O79,2,0)	
51	C22	=VLOOKUP(\$A22,J67:O79,2,0)	
52	C24	=VLOOKUP(\$A24,J67:O79,2,0)	
53	C26	=VLOOKUP(\$A26,J67:O79,2,0)	
54	C28	=VLOOKUP(\$A28,J67:O79,2,0)	
55	C30	=VLOOKUP(\$A30,J67:O79,2,0)	
56	C32	=VLOOKUP(\$A32,J67:O79,2,0)	
57	C34	=VLOOKUP(\$A34,J67:O79,2,0)	
58	C36	=VLOOKUP(\$A36,J67:O79,2,0)	
59	D12	=IFERROR((ROUND(IF(D7=0,0,D4/D7)*100,2))," ")	Calculates the required quantity of UREA for the select crop in a given area/(no.of plants) as per the recommendations
60	D14	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A14,J67:O79,3,0)*\$G14/100,2))*100/D\$7,2)," ")	
61	D16	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A16,J67:O79,3,0)*\$G16/100,2))*100/D\$7,2)," ")	
62	D18	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A18,J67:O79,3,0)*\$G18/100,2))*100/D\$7,2)," ")	
63	D20	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A20,J67:O79,3,0)*\$G20/100,2))*100/D\$7,2)," ")	
64	D22	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A22,J67:O79,3,0)*\$G22/100,2))*100/D\$7,2)," ")	
65	D24	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A24,J67:O79,3,0)*\$G24/100,2))*100/D\$7,2)," ")	
66	D26	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A26,J67:O79,3,0)*\$G26/100,2))*100/D\$7,2)," ")	
67	D28	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A28,J67:O79,3,0)*\$G28/100,2))*100/D\$7,2)," ")	
68	D30	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A30,J67:O79,3,0)*\$G30/100,2))*100/D\$7,2)," ")	
69	D32	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A32,J67:O79,3,0)*\$G32/100,2))*100/D\$7,2)," ")	
70	D34	=IFERROR(ROUND((D\$4-	

		ROUND(VLOOKUP(\$A34,J67:O79,3,0)*\$G34/100,2))*100/D\$7,2," ")		
71	D36	=IFERROR(ROUND((D\$4- ROUND(VLOOKUP(\$A36,J67:O79,3,0)*\$G36/100,2))*100/D\$7,2)," ")		
72	E12	=IFERROR((ROUND(IF(E7=0,0,E4/E7)*100,2))," ")		
73	E14	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A14,J67:O79,4,0)*\$G14/100,2))*100/E\$7,2)," ")		
74	E16	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A16,J67:O79,4,0)*\$G16/100,2))*100/E\$7,2)," ")		
75	E18	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A18,J67:O79,4,0)*\$G18/100,2))*100/E\$7,2)," ")		
76	E20	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A20,J67:O79,4,0)*\$G20/100,2))*100/E\$7,2)," ")		
77	E22	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A22,J67:O79,4,0)*\$G22/100,2))*100/E\$7,2)," ")		
78	E24	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A24,J67:O79,4,0)*\$G24/100,2))*100/E\$7,2)," ")	Calculates the required quantity of SSP for the select crop in a given area/(no.of plants) as per the recommendations	
79	E26	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A26,J67:O79,4,0)*\$G26/100,2))*100/E\$7,2)," ")		
80	E28	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A28,J67:O79,4,0)*\$G28/100,2))*100/E\$7,2)," ")		
81	E30	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A30,J67:O79,4,0)*\$G30/100,2))*100/E\$7,2)," ")		
82	E32	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A32,J67:O79,4,0)*\$G32/100,2))*100/E\$7,2)," ")		
83	E34	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A34,J67:O79,4,0)*\$G34/100,2))*100/E\$7,2)," ")		
84	E36	=IFERROR(ROUND((E\$4- ROUND(VLOOKUP(\$A36,J67:O79,4,0)*\$G36/100,2))*100/E\$7,2)," ")		
85	F12	=IFERROR((ROUND(IF(F7=0,0,F4/F7)*100,2))," ")		
86	F14	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A14,J67:O79,5,0)*\$G14/100,2))*100/F\$7,2)," ")		Calculates the required quantity of MOP for the select crop in a given area/(no.of plants) as per the recommendations
87	F16	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A16,J67:O79,5,0)*\$G16/100,2))*100/F\$7,2)," ")		
88	F18	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A18,J67:O79,5,0)*\$G18/100,2))*100/F\$7,2)," ")		
89	F20	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A20,J67:O79,5,0)*\$G20/100,2))*100/F\$7,2)," ")		
90	F22	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A22,J67:O79,5,0)*\$G22/100,2))*100/F\$7,2)," ")		
91	F24	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A24,J67:O79,5,0)*\$G24/100,2))*100/F\$7,2)," ")		
92	F26	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A26,J67:O79,5,0)*\$G26/100,2))*100/F\$7,2)," ")		
93	F28	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A28,J67:O79,5,0)*\$G28/100,2))*100/F\$7,2)," ")		
94	F30	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A30,J67:O79,5,0)*\$G30/100,2))*100/F\$7,2)," ")		
95	F32	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A32,J67:O79,5,0)*\$G32/100,2))*100/F\$7,2)," ")		
96	F34	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A34,J67:O79,5,0)*\$G34/100,2))*100/F\$7,2)," ")	Calculates the required quantity of COMPLEX for the select crop in a given area/(no.of plants) as per the recommendations	
97	F36	=IFERROR(ROUND((F\$4- ROUND(VLOOKUP(\$A36,J67:O79,5,0)*\$G36/100,2))*100/F\$7,2)," ")		
98	G12	-		
99	G14	=IF(G13=0," ",ROUND(G13,2))		
100	G16	=IF(G15=0," ",ROUND(G15,2))		
101	G18	=IF(G17=0," ",ROUND(G17,2))		
102	G20	=IF(G19=0," ",ROUND(G19,2))		
103	G22	=IF(G21=0," ",ROUND(G21,2))		
104	G24	=IF(G23=0," ",ROUND(G23,2))		
105	G26	=IF(G25=0," ",ROUND(G25,2))		
106	G28	=IF(G27=0," ",ROUND(G27,2))		
107	G30	=IF(G29=0," ",ROUND(G29,2))		
108	G32	=IF(G31=0," ",ROUND(G31,2))		
109	G34	=IF(G33=0," ",ROUND(G33,2))		
110	G36	=IF(G35=0," ",ROUND(G35,2))		
111	H12	=SUMPRODUCT(D12:F12,D6:F6)	Calculates the fertilizer cost for the select crop in a given area/(no.of plants) as per the recommendations	
112	H14	=IFERROR(IF(D14>0,(\$D\$6*D14,0)+IF(E14>0,(\$E\$6*E14,0)+IF(F14>0,(\$F\$6*F14,0)+(VLOOKUP(\$A14,J67:O79,2,0)*G14,0)		
113	H16	=IFERROR(IF(D16>0,(\$D\$6*D16,0)+IF(E16>0,(\$E\$6*E16,0)+IF(F16>0,(\$		

		F\$6*F16,0)+(VLOOKUP(\$A16,J67:O79,2,0)*G16,0)	
114	H18	=IFERROR(IF(D18>0,(\$D\$6*D18,0)+IF(E18>0,(\$E\$6*E18,0)+IF(F18>0,(\$F\$6*F18,0)+(VLOOKUP(\$A18,J67:O79,2,0)*G18,0)	
115	H20	=IFERROR(IF(D20>0,(\$D\$6*D20,0)+IF(E20>0,(\$E\$6*E20,0)+IF(F20>0,(\$F\$6*F20,0)+(VLOOKUP(\$A20,J67:O79,2,0)*G20,0)	
116	H22	=IFERROR(IF(D22>0,(\$D\$6*D22,0)+IF(E22>0,(\$E\$6*E22,0)+IF(F22>0,(\$F\$6*F22,0)+(VLOOKUP(\$A22,J67:O79,2,0)*G22,0)	
117	H24	=IFERROR(IF(D24>0,(\$D\$6*D24,0)+IF(E24>0,(\$E\$6*E24,0)+IF(F24>0,(\$F\$6*F24,0)+(VLOOKUP(\$A24,J67:O79,2,0)*G24,0)	
118	H26	=IFERROR(IF(D26>0,(\$D\$6*D26,0)+IF(E26>0,(\$E\$6*E26,0)+IF(F26>0,(\$F\$6*F26,0)+(VLOOKUP(\$A26,J67:O79,2,0)*G26,0)	
119	H28	=IFERROR(IF(D28>0,(\$D\$6*D28,0)+IF(E28>0,(\$E\$6*E28,0)+IF(F28>0,(\$F\$6*F28,0)+(VLOOKUP(\$A28,J67:O79,2,0)*G28,0)	
120	H30	=IFERROR(IF(D30>0,(\$D\$6*D30,0)+IF(E30>0,(\$E\$6*E30,0)+IF(F30>0,(\$F\$6*F30,0)+(VLOOKUP(\$A30,J67:O79,2,0)*G30,0)	
121	H32	=IFERROR(IF(D32>0,(\$D\$6*D32,0)+IF(E32>0,(\$E\$6*E32,0)+IF(F32>0,(\$F\$6*F32,0)+(VLOOKUP(\$A32,J67:O79,2,0)*G32,0)	
122	H34	=IFERROR(IF(D34>0,(\$D\$6*D34,0)+IF(E34>0,(\$E\$6*E34,0)+IF(F34>0,(\$F\$6*F34,0)+(VLOOKUP(\$A34,J67:O79,2,0)*G34,0)	
123	H36	=IFERROR(IF(D36>0,(\$D\$6*D36,0)+IF(E36>0,(\$E\$6*E36,0)+IF(F36>0,(\$F\$6*F36,0)+(VLOOKUP(\$A36,J67:O79,2,0)*G36,0)	
Hidden cells (some of the cell will be in hidden mode to make the Figure short and attractive)			
124	C6	Price (Rs/kg)	Title
125	D6	Price of N/kg	Displays prices of N, P, K/kg
126	E6	Price of P/kg	
127	F6	Price of K/kg	
128	C7	Available Quantity/100kg bag	Title
129	D7	Available Quantity of N/100kg bag	Available Quantities of N, P and K's in 100 kg bag
130	E7	Available Quantity of P/100kg bag	
131	F7	Available Quantity of K/100kg bag	
132	D13	=IFERROR(IF(VLOOKUP(\$A14,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A14,J67:O79,3,0))," ")	Computes the ratios of N
133	D15	=IFERROR(IF(VLOOKUP(\$A16,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A16,J67:O79,3,0))," ")	
134	D17	=IFERROR(IF(VLOOKUP(\$A18,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A18,J67:O79,3,0))," ")	
135	D19	=IFERROR(IF(VLOOKUP(\$A20,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A20,J67:O79,3,0))," ")	
136	D21	=IFERROR(IF(VLOOKUP(\$A22,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A22,J67:O79,3,0))," ")	
136	D23	=IFERROR(IF(VLOOKUP(\$A24,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A24,J67:O79,3,0))," ")	
137	D25	=IFERROR(IF(VLOOKUP(\$A26,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A26,J67:O79,3,0))," ")	
138	D27	=IFERROR(IF(VLOOKUP(\$A28,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A28,J67:O79,3,0))," ")	
139	D29	=IFERROR(IF(VLOOKUP(\$A30,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A30,J67:O79,3,0))," ")	
140	D31	=IFERROR(IF(VLOOKUP(\$A32,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A32,J67:O79,3,0))," ")	
141	D33	=IFERROR(IF(VLOOKUP(\$A34,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A34,J67:O79,3,0))," ")	Computes the ratios of P
142	D35	=IFERROR(IF(VLOOKUP(\$A36,J67:O79,3,0)=0,0,DS4/VLOOKUP(\$A36,J67:O79,3,0))," ")	
143	E13	=IFERROR(IF(VLOOKUP(\$A14,J67:O79,4,0)=0,0,ES4/VLOOKUP(\$A14,J67:O79,4,0))," ")	
144	E15	=IFERROR(IF(VLOOKUP(\$A16,J67:O79,4,0)=0,0,ES4/VLOOKUP(\$A16,J67:O79,4,0))," ")	
145	E17	=IFERROR(IF(VLOOKUP(\$A18,J67:O79,4,0)=0,0,ES4/VLOOKUP(\$A18,J67:O79,4,0))," ")	
146	E19	=IFERROR(IF(VLOOKUP(\$A20,J67:O79,4,0)=0,0,ES4/VLOOKUP(\$A20,J67:O79,4,0))," ")	
147	E21	=IFERROR(IF(VLOOKUP(\$A22,J67:O79,4,0)=0,0,ES4/VLOOKUP(\$A22,J67:O79,4,0))," ")	
148	E23	=IFERROR(IF(VLOOKUP(\$A24,J67:O79,4,0)=0,0,ES4/VLOOKUP(\$A24,J67:O79,4,0))," ")	
149	E25	=IFERROR(IF(VLOOKUP(\$A26,J67:O79,4,0)=0,0,ES4/VLOOKUP(\$A26,J67:O79,4,0))," ")	
150	E27	=IFERROR(IF(VLOOKUP(\$A28,J67:O79,4,0)=0,0,ES4/VLOOKUP(\$A28,J67:O79,4,0))," ")	

151	E29	=IFERROR(IF(VLOOKUP(\$A30,J67:O79,4,0)=0,0,ES\$4/VLOOKUP(\$A30,J67:O79,4,0))," ")	Computes the ratios of K
152	E31	=IFERROR(IF(VLOOKUP(\$A32,J67:O79,4,0)=0,0,ES\$4/VLOOKUP(\$A32,J67:O79,4,0))," ")	
153	E33	=IFERROR(IF(VLOOKUP(\$A34,J67:O79,4,0)=0,0,ES\$4/VLOOKUP(\$A34,J67:O79,4,0))," ")	
154	E35	=IFERROR(IF(VLOOKUP(\$A36,J67:O79,4,0)=0,0,ES\$4/VLOOKUP(\$A36,J67:O79,4,0))," ")	
155	F13	=IFERROR(IF(VLOOKUP(\$A14,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A14,J67:O79,5,0))," ")	
156	F15	=IFERROR(IF(VLOOKUP(\$A16,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A16,J67:O79,5,0))," ")	
157	F17	=IFERROR(IF(VLOOKUP(\$A18,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A18,J67:O79,5,0))," ")	
158	F19	=IFERROR(IF(VLOOKUP(\$A20,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A20,J67:O79,5,0))," ")	
159	F21	=IFERROR(IF(VLOOKUP(\$A22,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A22,J67:O79,5,0))," ")	
160	F23	=IFERROR(IF(VLOOKUP(\$A24,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A24,J67:O79,5,0))," ")	
161	F25	=IFERROR(IF(VLOOKUP(\$A26,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A26,J67:O79,5,0))," ")	
162	F27	=IFERROR(IF(VLOOKUP(\$A28,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A28,J67:O79,5,0))," ")	
163	F29	=IFERROR(IF(VLOOKUP(\$A30,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A30,J67:O79,5,0))," ")	
164	F31	=IFERROR(IF(VLOOKUP(\$A32,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A32,J67:O79,5,0))," ")	
165	F33	=IFERROR(IF(VLOOKUP(\$A34,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A34,J67:O79,5,0))," ")	
166	F35	=IFERROR(IF(VLOOKUP(\$A36,J67:O79,5,0)=0,0,FS\$4/VLOOKUP(\$A36,J67:O79,5,0))," ")	
167	G13	=ROUND(MIN(IF(D13:F13<>0,D13:F13))*100,3)	Finds the minimum ratio among three ratios
168	G15	=ROUND(MIN(IF(D15:F15<>0,D15:F15))*100,3)	
136	G17	=ROUND(MIN(IF(D17:F17<>0,D17:F17))*100,3)	
137	G19	=ROUND(MIN(IF(D19:F19<>0,D19:F19))*100,3)	
138	G21	=ROUND(MIN(IF(D21:F21<>0,D21:F21))*100,3)	
139	G23	=ROUND(MIN(IF(D23:F23<>0,D23:F23))*100,3)	
140	G25	=ROUND(MIN(IF(D25:F25<>0,D25:F25))*100,3)	
141	G27	=ROUND(MIN(IF(D27:F27<>0,D27:F27))*100,3)	
142	G29	=ROUND(MIN(IF(D29:F29<>0,D29:F29))*100,3)	
143	G31	=ROUND(MIN(IF(D31:F31<>0,D31:F31))*100,3)	
144	G33	=ROUND(MIN(IF(D33:F33<>0,D33:F33))*100,3)	
145	G35	=ROUND(MIN(IF(D35:F35<>0,D35:F35))*100,3)	
Other information regarding initial tables provided in two sheets			
146	J66:O70	Table-1 proves the Cost of Complex per kg	Will be changed as per new prices and recommendations
147	I82: Q251	Table-2 Crop and season wise recommendations	
148	A1:C170	List of crops for which this programme has been designed (available in other sheet <i>Crops</i>)	

15. Figure shots of the ANGRAU Fertiliser Planner-2015 (AFP-15)

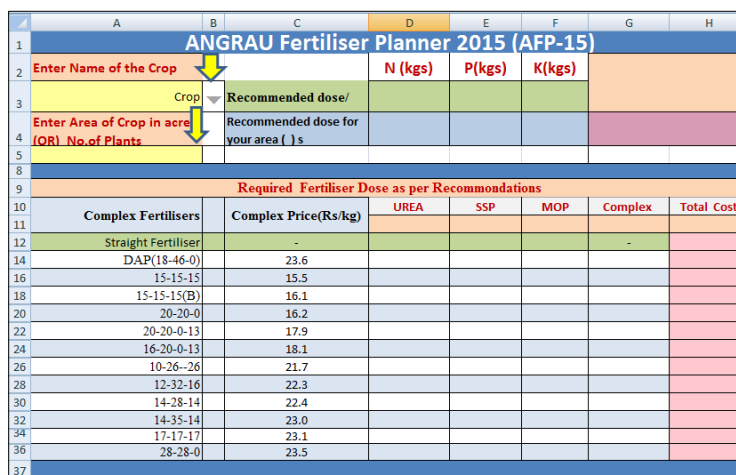


Fig 1: Open figure of the ANGRAU Fertiliser Planner 2015 (AFP-15)

Example 1: If a farmer wishes to cultivate Groundnut in a Rabi season in the area 2 acres and 20 cents then select crop as *Groundnut Rabi* in cell A3 and enter the value 2.20 under

the *area of crop* in the cell A5 and observe the output as shown in Screen-2.

ANGRAU Fertiliser Planner 2015 (AFP-15)							
Enter Name of the Crop		N (kgs)	P(kgs)	K(kgs)	Total Minimum cost (Rs.)		
Groundnut Rabi	Recommended dose/acre	12.00	16.00	20.00	for 2.2 acre(s)		
Enter Area of Crop in acre (OR) No. of Plants	Recommended dose for your area (2.2) acres	26.4	35.2	44	3193.12		
2.2							
Required Fertiliser Dose as per Recommendations							
Complex Fertilisers	Complex Price(Rs/kg)	UREA	SSP	MOP	Complex	Total Cost	
		kg/2.2acre(s)	kg/2.2acre(s)	kg/2.2acre(s)	kg/2.2acre(s)	Rs./2.2acre(s)	
Straight Fertiliser	-	57.39	220	73.33	-	3225.33	
DAP(18-46-0)	23.6	27.46	0	73.33	76.52	3193.12	
15-15-15	15.5	0	55	29.33	176.00	3645.40	
15-15-15(B)	16.1	0	55	29.33	176.00	3738.75	
20-20-0	16.2	0	55	73.33	132.00	3787.08	
20-20-0-13	17.9	0	55	73.33	132.00	4007.46	
16-20-0-13	18.1	0	13.75	73.33	165.00	4329.54	
10-26-26	21.7	27.96	0	14.67	135.39	3335.58	
12-32-16	22.3	28.7	0	44	110.00	3348.52	
14-28-14	22.4	19.13	0	44	125.71	3667.26	
14-35-14	23.0	26.78	0	49.87	100.57	3300.89	
17-17-17	23.1	0	55	29.33	155.29	4501.61	
28-28-0	23.5	0	55	73.33	94.29	3867.64	

Fig 2: Output Screen of the ANGRAU Fertiliser Planner 2015 (AFP15) for Groundnut-Rabi

Example 2: If a farmer has 100 Mango trees (age of two years), select crop as *Mango (2 years)* in cell A3 and enter the

value 100 under the *no. of plants* in the cell A5 and observe the output as shown in Screen-3.

ANGRAU Fertiliser Planner 2015 (AFP-15)							
Enter Name of the Crop		N (kgs)	P(kgs)	K(kgs)	Total Minimum cost (Rs.)		
Mango(2 years)	Recommended dose/ plant	0.20	0.20	0.20	for 100 plant(s)		
Enter Area of Crop in acre (OR) No. of Plants	Recommended dose for your area (100) plants	20	20	20	1735.12		
100							
Required Fertiliser Dose as per Recommendations							
Complex Fertilisers	Complex Price(Rs/kg)	UREA	SSP	MOP	Complex	Total Cost	
		kg/100plant(s)	kg/100plant(s)	kg/100plant(s)	kg/100plant(s)	Rs./100plant(s)	
Straight Fertiliser	-	43.48	125	33.33	-	1753.43	
DAP(18-46-0)	23.6	26.46	0	33.33	43.48	1735.12	
15-15-15	15.5	0	0	0	133.33	2071.65	
15-15-15(B)	16.1	0	0	0	133.33	2142.37	
20-20-0	16.2	0	0	33.33	100.00	2178.98	
20-20-0-13	17.9	0	0	33.33	100.00	2345.94	
16-20-0-13	18.1	8.7	0	33.33	100.00	2422.66	
10-26-26	21.7	26.76	0	0	76.92	1815.94	
12-32-16	22.3	27.17	0	16.67	62.50	1823.46	
14-28-14	22.4	21.74	0	16.67	71.43	2004.69	
14-35-14	23.0	26.09	0	20	57.14	1796.32	
17-17-17	23.1	0	0	0	117.65	2720.49	
28-28-0	23.5	0	0	33.33	71.43	2239.98	

Fig 3: Output Screen of ANGRAU Fertiliser Planner 2015 (AFP-15) for Mango (2 years)

References

1. Chien SH, Prochnow LI, Cantarella H. Recent developments of fertilizer production and use to improve nutrient efficiency and minimize environmental impacts. *Adv Agron.* 2009; 102:267-322.
2. Fertiliser. Association of India. 2003/04. Fertiliser and agriculture statistics. New Delhi.
3. Garcia-Albacete M, Martin A, Cartagena CM. Fractionation of phosphorus biowastes: characterisation and environmental risk. *Waste Mgt* 2012; 32:1061-1068.
4. https://www.tutorialspoint.com/excel/excel_bultin_functi ons.htm.