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A Computer Programme for Preparing Mixed Fertilizers

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INTRODUCTION

The calculations involved in preparing mixed fertilizers of a given ratio can be tedious and time-consuming, especially when dealing with straight fertilizers that contain both primary and secondary nutrients. Thus, a program named CTSS-MIFEC (Centre for Tropical Soil Studies-Mixed Fertilizer Calculator) was developed to reduce the length of time required to calculate and determine the amount of organic and inorganic straight fertilizers for making mixtures of a given ratio. This can also be used as a decision-making tool to determine new combinations for preparing mixed fertilizers.

PROGRAMME DESCRIPTION

Initially, CTSS-MIFEC ran in MS-DOS operating system and could only handle total amounts of fertilizer higher than 1000 kg urea, triple superphosphate (TSP), muriate of potash (MOP), German kieserite (GK), Calcium carbonate (CC) and Ammonium sulphate (AS) were set as default straight fertilizers for producing N, P₂O₅, K₂O, MgO, CaO and S nutrients, respectively. Later, the programme was modified to include other inorganic sources such as diammonium phosphate (DAP), sulphate of potash (SOP), ammonium nitrate (AN), and ground magnesium limestone (GML), as well as to calculate the required amount of fertilizer. This programme was compiled in Microsoft Visual C++ version 6.0 and has a GUI (Graphic User Interface) for easy

use. The computer system requirements are IBM-PC, Microsoft Windows 95 and above, 16 MB RAM, and a disk space of about 2 MB.

Several possible inorganic straight fertilizers (inputs) were chosen and programmed into the software. The calculations were based on the fertilizer carrier grades of primary and selected secondary nutrients. A special function was included for the user who is interested to use organic matter as part of the mixture.

The inorganic fertilizers (inputs) used in this software include urea, TSP, MOP, GK, CC, AS, Christmas Island rock phosphate (CIRP), DAP, SOP, GML, calcium nitrate (CN), potassium nitrate (KN) and AN. The abbreviations used here are similar to the ones in the programme. Table 1 shows the selected straight inorganic fertilizers, with the percentage of primary and selected secondary nutrients.

Table 1. The straight inorganic fertilizers used (primary and selected secondary nutrients).

Inorganic Fertilizers	%					
	N	P ₂ O ₅	K ₂ O	MgO	CaO	S
TSP (Triple Super Phosphate)		46				
Urea	46					
AS (Ammonium Sulphate)	21					24
MOP (Muriate of Potash)			60			
DAP (Diammonium Phosphate)	18	46				
CC (Calcium Carbonate)					54	
CIRP (Christmas Island Rock Phosphate)		34			40	
GK (German Kieserite)				27		
GML (Ground Magnesium Limestone)				12	30	
SOP (Sulphate of Potash)			50			16
CN (Calcium Nitrate)	15					34
KN (Potassium Nitrate)	13		44			
AN (Ammonium Nitrate)	33					

USING CTSS-MIFEC

Using CTSS-MIFEC involves three main steps. Once the program is loaded, the user needs to enter the total amount of fertilizer required. Next, the desired percentage of nutrients is entered. There are six sub-sections, which are the N, P₂O₅, K₂O, MgO, CaO and S nutrients. Each sub-section has a list of straight fertilizers and the user can only choose one straight fertilizer from each sub-section. The last section, which deals with the amount of OM (organic matter), is optional. Note that the user must first know the nutrient contents in the OM in order to use this function. Finally, the amount of chosen

straight fertilizer needed for each nutrient is determined by pressing the *Calculate* button, and the amount of filler is calculated automatically as well.

Since this programme is to be used as a decision-making tool, the user can enter any desired ratio of the mixture. However, a negative *Filler* value is an indication that the ratio for the particular mixture is not possible. Therefore, the user needs to make some adjustments by lowering the percentage of the fertilizer or the amount of OM.

EXAMPLE OF CALCULATIONS AND SOFTWARE DEMONSTRATION

Prepare 1000 kg of fertilizer mixture (urea + TSP + MOP) with a grade of 8: 8: 15 and containing 300 kg of chicken manure. Analysis of chicken manure is: 3.0% N, 2.5% P₂O₅ and 2.0% K₂O.

Manual calculations:

N

From chicken manure =
3/100 x 300 = 9 kg

N needed = (8% x 1000) - 9 =
71 kg

∴ From Table 1, urea needed =
71 x 100/46 = 154 kg

P₂O₅

From chicken manure =
2.5/100 x 300 = 7.5 kg

P₂O₅ needed = (8% x 1000) - 7.5 =
72.5 kg

∴ From Table 1, TSP needed =
72.5 x 100/46 = 158 kg

K₂O

From chicken manure =
 $2/100 \times 300 = 6 \text{ kg}$

$K_2O \text{ needed} = (15\% \times 1000) - 6$
 $= 144 \text{ kg}$

\therefore From Table 1, MOP needed =
 $144 \times 100/60 = 240 \text{ kg MOP}$

Total nutrients =
 $(300 + 154 + 158 + 240) \text{ kg}$
 $= 852 \text{ kg}$

\therefore Filler = $(1000 - 852) \text{ kg} =$
 148 kg

Calculations done by software:

Amount of fertilizer wanted (kg): 1000		
N	P2O5	K2O
% N wanted: 8	% P2O5 wanted: 8	% K2O wanted: 15
N source: Urea	P2O5 source: TSP	K2O source: MOP
MgO	CaO	S
% MgO wanted: 0	% CaO wanted: 0	% S wanted: 0
MgO source:	CaO source:	S source:
Organic Matter (OM)		
Amount of OM wanted (kg): 300	% N in OM: 3	
	% P2O5 in OM: 2.5	
	% K2O in OM: 2	
Buttons: Calculate, Help, Exit		

Figure 1: Data entry

Amount needed (kg)	
N:	154.3478
P2O5:	157.6087
K2O:	240
MgO:	0
CaO:	0
S:	0
Filler:	148.0435
Button: OK	

Figure 2: Results of fertilizer mixture

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