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Customized Fertilizers for Maximizing Fertilizer Use Efficiency

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Introduction:

It is crucial to expand food production in order to meet the 1.4 billion predicted people's need for food grains, with an expected annual population growth rate of 1.1% by the year 2025. India's need for food grains is anticipated to reach around 300 million tonnes annually by 2025(FAI, 2018).Out of total 328.7 million ha. geographical area, 140.2 million ha. (43% of total area) is under net cultivable area under cultivation. These erratic fertilizer use patterns cause greater drain on native soil fertility and the soil may not be able to support high production levels in future. Fertilizer consumption has been increased from 69.8 metric tonnes (MT) in 1951-52 to the 29,796 MT in 2021-22 owing to decline in soil health and causing soil and water pollution.

The nutrient use efficiency of phosphorus (P) is 15-20% in most crops, whereas the efficiency of nitrogen (N) is only 30-40% in rice and 50-60% in other cereals. The efficiency of potassium (K) is 60-80%, while that for sulphur(S) is 8-12%. In case of micronutrients, the efficiency is below 5%. Even with application of a greater number of fertilizers still nitrogen and zinc (Zn) are the most limiting nutrients for plant growth. Conventional fertilizers have very less fertilizer use efficiency because majority of the fertilizer is lost through environment losses. So, there is a need to improve the efficiency of fertilizers, improve crop yield without decline in soil health. These erratic fertilizer use patterns, if continued for years, could cause much greater drain on native soil fertility and the soil may not be able to support high production levels in future. Therefore, in the event of nutrient turnover in soil-plant system being considerably high under intensive farming, neither chemical fertilizer nor organic/biological sources alone can achieve production sustainability. So, in order to cope

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with these problems there is a need to use customized fertilizers to provide site specific nutrient management.

Customized fertilizers are distinct, ready-to-use granular fertilizers that are developed using strong scientific plant nutrition principles in conjunction with knowledge of the soil, comprehensive laboratory testing, and field evaluation (Choudhary *et al.*, 2020). According to the Fertilizer Control Order (FCO), customized fertilizers are important and are defined as: Multinutrient carriers made using a systematic granulation process that are suited to the site, soil, and stage of the crop and contain macro, secondary, and/or micronutrients from both inorganic and/or organic sources and capability developed by an accredited fertilizer manufacturing/marketing company. In short customized fertilizers are multi-nutrient carrier which contain macro and micro nutrients whose source from inorganic or organic produced by specific granulation process to satisfy crop nutritional demand specific to growth stage and agroecological region. The customized fertilizer grade is designed based on soil test crop response, response cure approach, software tools like Decision Support System for Agro Technology Transfer (DSSAT),crop Model *etc.* to determine the optimal grades of customized fertilizer. Use of conventional fertilizers cause irregular distribution near root zone, low crop response, yield reduction, decline in soil health, Whereas, customized fertilizers are finely blended, location and crop specific, uniformly distributed near root zone, efficient crop response, improve soil health comparatively.

Advantages of customized fertilizers

- Eco- friendly fertilizers
- Compatibility with farming systems
- Improved Fertilizer Use Efficiency
- Control of nutrient deficiencies in plants
- Reduced additional costs of micronutrient fertilizers
- Key component of site-specific nutrient management and precision agriculture
- Enhanced crop production and soil health

Hindrances for customized fertilizers

- High cost of production
- High capital investment on manufacturing infrastructure

Features of customized fertilizers:

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- Unique
- Ready to use
- Formulated scientifically
- Complex development process
- Nutrient use efficiency is optimal

Manufacturing methods for customized fertilizers:

- Bulk blending
- Compound or steam granulation
- Complex/ chemical granulation
- Compaction
- Fluid method

Steps involved in fertilizers recommendation by use of customized fertilizers:

1. Geographical mapping or Geo-referencing of chosen region or field
2. Selection of sampling points based on appropriate statistical procedure
3. Sampling and analyzing of sites
4. Analyzing soil, water and plant samples
5. Defining management zones and yield targeting in major management zones
6. Computing crop removal of nutrients
7. Calculating nutrient requirement of soil and crop
8. Blending of nutrients based on general information

Important companies in market producing customized fertilizers:

- ✓ Tata Chemicals Limited (TCL)
- ✓ NagarjunaFertilizers Corporation Limited (NFCL)
- ✓ Deepak Chemicals and Petrochemicals Corporation Limited (DCPCL)
- ✓ Coromandel

Company	**Crops**	**Formulations (N:P:K:S:Zn:B)/ N:P:K:Zn/N:P:K:S:Mg:Zn:B:Fe/N:P:K:S:Zn:B)**	**Geography**
TCL	Potato	8:16:24:6:0.5:0 .15	Agra, Aligarh, Budaun,

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			Bulandshahar and Baghpath
TCL	Wheat	10:18:25:3:0.5 :0.5	Muzaffarnagar, Barielly, Bijnore, Hathras, Pilibhit, Mathura, Meerut and Etah
TCL	Paddy	15:32:8:0.5, 18 :33 :7:0.5, 18:27:1 4:0 .5	Andhra Pradesh
TCL	Maize	14:27:10:4:0.5	Karimnagar, Warangal and Ranga Reddy
TCL	Sugarcane	7:20:18:6:0.5	Western UP
NFCL	Rice	11:24:6:3:0.5	Andhra Pradesh
NFCL	Maize	14:27:10:4:0.5	Adilabad, Nizambad, Karimnagar
Coromandel	Maize	14:20:14:4:0.5	Adilabad, Nizambad, karimnagar
Coromandel	Groundnut	17:17:17:4:0.5:0.2	Anantpur, chittor,kadapa, Kurnool
DCPCL	Groundnut	15:15:15:9:0.5:0.2	Andhra Pradesh
DCPCL	Maize	20:0:15:0 :0:0.2	Andhra pradesh
DCPCL	Paddy(Basal)	16:22:14:4:1:0	East Godawari, West Godawari, Krishna, Guntur

N: Nitrogen; P: Phosphorus; K: Potassium; Zn: Zinc; S: Sulphur; Mg: Magnesium; B: Boron; Fe: Iron

Customized fertilizers were included in the Gazette in 2006 under clause 20B of FCO 1985. Later customized fertilizers policy guidelines were issued on 2008 by Government of India. For increase in usage of these fertilizers government should support by giving subsidies and organizing awareness campaigns at village level and also should focus on supply level as per the demand.

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