



# ADUBOFERTIL

$$\sum_{i=1}^n \sum_{j=1}^m (CF_i) \cdot (MF_i^j) \cdot (Y_i^j)$$

Conjugar o verbo adubar implica ao agrônomo, após **análise química**, prescrever as quantidades de nutrientes para o cultivo de uma lavoura, cabendo ao administrador, após **análise de preços**, listar os fertilizantes disponíveis no mercado. Ao departamento de compras, após **análise matemática**, resta escolher esses que servirão ao agrônomo (restrições químicas) e ao administrador (restrições financeiras).

Adubar torna-se um desafio combinatório quando é necessário escolher, entre **n** fertilizantes (compostos de **m** elementos químicos), aqueles que podem fertilizar **P** lotes de cultivares com o menor custo.

$$\sum_{i=1}^n (PQ_k^i) \cdot (MF_j^i) \cdot (Y_i^j) \geq X^j$$

## Modelo para Adubar Terras

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Fertilizantes	Composição Química dos Fertilizantes															Custo (um/kg)	Massa Mínima (kg)	Massa Máxima (kg)		
	N	P	K	Ca	Mg	S	B	Cu	Fe	Zn	Na	Si	Mo	Al	CR				OU	
1	AMONIA ANDRA	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0	0.6100	50.0	200000.0
2	NITRATO DE AMONIO	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67.2	2.8	0.5300	25.0	200000.0
3	UREIA	42.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	51.0	0.0	0.5800	50.0	200000.0
4	SULFATO DE AMONIO	22.0	0.0	0.0	0.0	21.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	55.0	0.0	0.5600	50.0	200000.0
5	NITRATO DE POTASSIO	12.0	0.0	42.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	34.0	0.0	0.6000	25.0	200000.0
6	FOSEFATO SIMPLES (SS)	0.0	17.0	0.0	18.0	0.0	11.0	0.0	5.0	0.0	0.0	5.0	0.0	0.0	0.0	35.0	9.0	0.4700	50.0	200000.0
7	FOSEFATO TRIPLO (ST)	0.0	41.0	0.0	13.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	4.9	0.7100	50.0	200000.0
8	MAP	11.0	50.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	5.0	0.0	6.0	0.0	0.0	23.0	0.0	0.7500	50.0	200000.0
9	DAP	16.0	39.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.0	0.0	0.5000	25.0	200000.0
10	FOSMAG	0.0	17.0	0.0	17.0	2.5	10.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	46.0	0.5	0.5100	50.0	200000.0
11	KCL	0.0	0.0	59.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	32.0	0.0	0.3600	50.0	100000.0
12	SULFATO DE POTASSIO	0.0	0.0	49.0	0.0	0.0	18.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	27.0	0.0	0.7000	25.0	200000.0
13	SPM	0.0	0.0	20.0	0.0	14.0	22.0	0.0	0.0	3.0	0.0	0.0	8.0	0.0	0.0	27.0	6.0	0.2000	25.0	200000.0
14	FÓRMULA P	19.0	4.0	19.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	4.0	0.2500	50.0	200000.0
15	FÓRMULA U	4.0	24.0	24.0	0.0	0.0	0.0	0.0	5.0	0.0	6.0	0.0	0.0	0.0	0.0	33.0	0.0	0.1500	50.0	100000.0
16	FÓRMULA K	19.0	0.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0	0.2200	50.0	100000.0
17	FÓRMULA S	15.0	6.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	1.0	0.3600	50.0	100000.0
18	FÓRMULA 1	5.0	19.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.0	1.0	0.4300	50.0	100000.0
19	VINHAÇA	0.6	0.0	1.0	2.0	0.2	0.0	6.0	0.0	0.0	6.0	0.0	0.0	2.0	0.0	70.0	12.3	0.0027	50.0	100000.0
20	GARAPÃO	0.5	0.0	1.0	2.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.0	9.3	0.0010	50.0	100000.0
21	TORTADE FILTRO	1.7	1.5	0.4	0.0	0.0	0.0	0.0	1.0	0.0	0.0	6.0	0.0	0.0	0.0	81.0	8.4	0.0100	50.0	100000.0
22	COMPOSTAGEM	1.7	1.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	0.0	0.0	85.0	0.4	0.0100	50.0	200000.0
23	CALCÁRIO DOLOMITICO ITAU	0.0	0.0	0.0	33.0	11.0	0.0	2.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	51.0	0.0	0.0600	50.0	200000.0
24	CALCÁRIO CALCITICO ITAU	0.0	0.0	0.0	42.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0600	50.0	200000.0
25	DOLOMITICO ENBRACAL	0.0	0.0	0.0	25.0	17.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	3.0	0.0500	50.0	200000.0
26	CALCITICO ENBRACAL	0.0	0.0	0.0	50.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.0	4.0	0.0500	50.0	200000.0
27	DOLOMITICO DIAMANTE	0.0	0.0	0.0	25.0	16.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	53.0	0.0	0.0400	50.0	200000.0

