Table 2. Agronomic variables of determinate and indeterminate types of red gram recorded at 45 DAS

Varieties	Plant height (cm)	LAI	DMP (mg ha^{-1})	Chlorophyll content (mg g^{-1})
Determinate varieties				
Vamban-I	28.56	1.48	2.68	0.93
ICPL-87	30.41	1.45	3.37	0.88
CoRG 9301	34.67	1.52	2.68	1.03
Indeterminate varieties				
Co-5	32.25	1.70	3.42	1.07
ICPL-88027	28.52	1.50	2.78	0.82
SED	0.995	2.08	0.584	0.155
CD (0.05)	2.168*	4.53**	NS	3.366*

Table 3. Vegetation indices of determinate and indeterminate varieties of red gram computed at 45 DAS.

Varieties	IR/R	IR-R	NDVI	TVI	PVI	GI
Determinate varieties						
Vamban-I	20.20	2.497	0.453	0.927	16.19	19.02
ICPL-87	24.17	2.273	0.377	0.936	16.98	18.36
CoRG 9301	20.90	2.222	0.379	0.937	19.98	16.19
Indeterminate varieties						
Co-5	25.07	2.565	0.439	0.969	19.77	19.59
ICPL-88027	24.47	2.630	0.449	0.974	19.14	20.16
SED	2.98	0.84	0.06	0.04	1.01	1.09
CD (0.05)	5.23	1.86	0.13	0.09	2.21	2.49

discrimination of determinate and indeterminate varieties of red gram.

Spectral reflectance and agronomic variables

An analysis was made on the agronomic variables which caused the spectral differences of determinate and indeterminate red gram varieties at 45 DAS. It was found that plant growth variables like plant height, leaf area index and chlorophyll content were responsible for spectral differences among the different cultivars of red gram (Table 2). Similar findings were reported for wheat crop by Hinzman *et al.*,. (1986).

Vegetation indices and varietal discrimination

Spectral vegetation indices are good indicators of crop growth conditions (Sundara sarma and DAS, 1994). Hence, the feasibility of differentiating the red gram varieties was attempted by using the spectral vegetation indices at 45 DAS.

Among these indices, discrimination effect was more pronounced with vegetation indices like IR/R, IR-R, Perpendicular vegetation index (PVI) and Greeness index (GI) (Table 3). These findings agree with the reports of Patel *et al.*, (1995). Higher values of vegetation indices were recorded for indeterminate varieties compared to indeterminate varieties as in the case of reflectance of spectral bands.

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CYTOZYME FOR INCREASED YIELD OF GROUNDNUT

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ABSTRACT

Foliar application of cytozyme to groundnut crop at peg formation stage at 0.05 percent concentration gave an increased pod yield of 18.5 per cent over control. This spray application also resulted in 23.0 percent increase in LAI, 27.9 percent increase in chlorophyll content and significant increase is macro and micronutrient uptake. The oil content of kereal also increased by 7.1 per cent over control.

Cytozyme a bioproduct recently introduced in the market is a crop growth regulator formulation containing enzymes, hormones, micronutrients and amino acids. Though its positive influence on

several crops are known (Asandhi and Sumiati 1987 ; Halwankar et al., 1984 ; Hoods *et al.*, 1985 ; Deshpande and Lakhdive, 1989 ; Silva and Stuff, 1981) information on the influence on growth and yield attributing characters of groundnut are scanty. The present study was therefore taken up for a detailed investigation on the spray concentration and time of applications.

MATERIALS AND METHODS

A field experiment was conducted during (January - April) 1992 at the Agricultural Research Station, Bhavanisagar, TNAU, to study the effect of cytozyme sprayings on growth, yield and nutrient uptake of groundnut (var. Co.2) The following treatments were laid out in a Randomised Block Design with five replication.

T_1 - Control (Water spray)

T_2 - Cytozyme as 0.05% spray at flowering

T_3 - Cytozyme as 0.10% spray at flowering

T_4 - Cytozyme as 0.05% spray at Peg formation

T_5 - Cytozyme as 0.10% spray at Peg formation

Recommended doses of NPK fertilizers were given at scheduled time. At panicle initiation stage, plant height, leaf area index (LAI) and dry matter yields were recorded and the total chlorophyll content in the fresh leaves were estimated (Arnon, 1949). At maturity pod and haulms yield were recorded. The kernels were analysed for oil content in the Hexane (B.P.75 - 80^{0}C) extract (A.O.A.C., 1962). N, P, K, Zn, Fe, Cu and Mn were estimated by standard methods and their uptake were computed. The data were subjected to statistical scrutiny (Panse and Sukhatme, 1967) and the results are discussed.

RESULTS AND DISCUSSION

Plant height, LAI and chlorophyll content of leaves

Plant growth was the tallest (28.4 cm) in T_4 which was significantly higher than the rest followed by T_5, T_3, T_2 and T_1 which significantly vary from each other. Similarly LAI in T_4 (3.26 cm^2) was the largest and on par with T_5 and T_3 but significantly larger than T_2 and T_1. The increase in LAI due to spray application of cytozyme at 0.05 percent at peg formation stage (T_4) was 23.0 per cent over control while the increase in LAI due to application of the same spray concentration of cytozyme at flowering (T_2) was only 10.2 percent over control. As compared to control, chlorophyll

Table 1. Influence of cytozyme on growth and yield of groundnut (Mean of five replications)

Particulars	Treatments					CD (P=0.05)
	T_1	T_2	T_3	T_4	T_5	
Plant height at P.F. (cm)	22.3	24.1	24.6	28.4	25.6	0.40
LAI at P.F.	2.6	2.92	3.17	3.26	3.12	0.26
Dry matter yield at P.F. (kg ha^{-1})	1715	2124	2365	3067	2746	34
Total chlorophyll at P.F. (mg/g)	1.90	2.11	2.20	2.43	2.31	0.01
Pod yield (kg ha^{-1})	1565	1671	1702	1855	1745	25
Haulms yield (kg ha^{-1})	4022	4148	4244	4416	4329	75
Oil content (%)	47.6	49.4	49.9	51.0	50.4	0.3
N uptake (kg ha^{-1})	127.2	138.3	143.5	160.3	149.6	9.1
P uptake (kg ha^{-1})	11.6	13.6	15.0	20.1	17.2	1.3
K uptake (kg ha^{-1})	43.3	50.9	56.0	70.3	61.8	6.1
Zn uptake (g ha^{-1})	266	296	320	378	345	20.2
Fe uptake (g ha^{-1})	652	761	841	1013	944	69.0
Cu uptake (g ha^{-1})	56.5	65.6	73.9	82.5	75.0	5.3
Mn uptake (g ha^{-1})	122	143	151	178	161	19.0

P.F. - Peg formation stage

content of leaves recorded 11.1, 15.8, 27.9 and 21.6 percent increases in T_2, T_3, T_4 and T_5 which were significant.

Dry matter and pod yield

Increased LAI facilitated larger exposure of canopy for incident radiant energy resulting in higher photosynthetic activity and accumulation of dry matters (DM). The highest dry matter at peg formation was in T_4 (3067 kg ha^{-1}) which was significantly higher than the rest, the increase in DM over control being 78.8 per cent. Similar trend was recorded for haulms yield at harvest. Similar observations were recorded for rice (Mathan and Krishnamurthi) and soybean by other growth regulators (Dashora and Jain, 1994).

Data (Table 1) show that application of cytozyme either at flowering or at peg formation stage as 0.05 or 0.10 percent spray resulted in significant increase of groundnut pod yield as compared to control. Application as 0.05 percent spray at peg formation stage (T_4) gave the highest pod yield (1855 kg ha^{-1}) which was 18.5 per cent higher than control. The increase in pod production over control was 6.8, 8.8 and 11.5 over control in T_2, T_3 and T_5 respectively. The results are corroborated with those of Ries *et al.*, (1978).

Nutrient uptake and oil content

The pattern of nutrient uptake which is definitely a function of dry matter production and cellular content of the nutrients was confirmed in the present study. The higher uptake of N, P, K, Cu, Fe, Mn and Zn were 160.3, 20.1, 70.3, kg ha^{-1} and 8.25, 1013, 178 and 378 g ha^{-1} respectively and were recorded in T_4. The increased uptake over control was 26.0, 73.3, 62.4, 46.0, 55.4, 45.9 and 42.1 percent respectively. The highest oil content was recorded in T_4 (51.0 percent) which was significantly higher than the rest and followed by T_5, T_3, T_2 and T_1 the percentage increase over control being 7.1, 5.9, 4.8 and 3.8 respectively. This might be due to the physiological and metabolic activities kindled by the harmonic and micronutrient components of cytozyme.

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