PRELIMINARY STUDIES ON INFLUENCE OF STARTER SOLUTION AND BETA-INDOLE ACETIC ACID ON FURTHER GROWTH AND DEVELOPMENT OF ONION (ALLIUN CEPA, Linn.) TRANSPLANTS

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APPLICATION of starter solutions of the essential elements, given in the vicinity of the root system of transplants in a readily available form and in desired quantities are believed to reduce the shock and to stimulate the growth of young seedlings. Growth regulator treatments to transplants before setting in the field are also known to render beneficial effects on the plants. Fertilizers and growth substances are now regarded as essential aids to the increased production of commercial vegetable crops. This has led to intensive researches about the nature of responses of these fertilizers and growth substances.

Pearse (1948) and Anonymous (1949 and 1952) found that the application of nitrogenous fertilizers in irrigation water secured very good results. Sayre (1939) pointed out that nutrient solution, when applied to soil in immediate contact with roots, was entirely absorbed by the plants. Carrier and Snyder (1950), McCrory (1946) and Campbell (1958) stated the use of starter solutions in increasing vegetable production. Baker (1937) obtained increased yields with the addition of commercial P_2O_5 and mono-ammonium phosphate to the transplanting water.

Besides starters, synthetic plant growth regulators applied as solutions before transplanting also affect the growth of seedlings favourably. Laude (1941), Macht and Crumbein (1937) obtained encouraging results with the use of Indole-acetic acid on different crops. Amlong (1943), Mennum (1941) and Tureckaja (1948) obtained significantly higher yields by treating the roots of several vegetable crops with growth substance solutions prior to transplanting to the open ground.

Present investigation was, therefore, carried out to study the influence of starter solutions and beta-indole acetic acid on the growth and development of a popular bulb crop like onion (*Allium cepa*, Linn.).

MATERIAL AND METHODS

The trial was laid out in a randomised design accommodating 24 plots with six treatments replicated four times. The following treatments were practised :—

(1) **Dung Starter**: Fifteen pounds of fresh cow-dung was mixed with ten gallons of water in an earthen container. The mixture was stirred daily for ten days, and then decanted and filtered through a coarse cloth to obtain a clear liquid. This filterate was diluted with tap water till it developed a light tea colour and kept ready for use (Treatment A.)

(2) **Chemical Starters**: Two chemical starters were prepared by dissolving (*a*) ammonium sulphate (1.5 lbs.) and potassium dihydrogen phosphate (2.2 lbs.) ; and (*b*) sodium nitrate (2.2 lbs.) separately in 35 gallons of water (Treatments B and C respectively). The solutions were thoroughly stirred before application.

(3) **Growth Regulator Solutions**: Two concentrations of indole-acetic acid viz., 10 and 20 parts per million (Treatments D and E respectively), were prepared in distilled water. Control plants (Treatment F) were supplied with tap water.

Treatment of Seedlings: Healthy and uniform-sized seedlings (40 days old) were uprooted from the nursery. The roots were thoroughly washed with tap water to remove the adhering soil. Roots of the two lots were immersed in 10 and 20 p.p.m. solutions of indole-acetic acid for four hours, prior to transplanting in the open field. Roots of the seedlings meant for other treatments were immersed in tap water for a similar duration. These seedlings were washed with water and transplanted on November 28 (at a distance of 9 inches in rows one foot apart) in randomly selected beds.

Respective starter solutions were applied around the root zone immediately after transplanting at the rate of one pint per plant. Control and regulator treated transplants were supplied with an equal amount of water.

Observations were started one month after transplanting. Height and number of leaves per plant were noted at ten days interval, while fresh and dry weight of leaves and bulbs were determined fortnightly.

EXPERIMENTAL FINDINGS

(*a*) **Maximum Height of Plants**: The height of the plants growing under the influence of different treatments varied considerably. Treated plants gave a superior response over the control (Table 1). From the very start of the initial observation, there was a steady increase in height of the treated plants, particularly the treatment B (Figs. 1—5). Treatment B produced a significantly superior height (61.97 cm.) as compared to others (except C). Control plants attained the minimum average height (52.97 cm.)

It is evident from the Table 1 that the period between 50 and 60 days after transplanting was the grand period of increase in height. A decline in height of plants was observed after 100 days of transplanting.

(*b*) **Average Number of Leaves per Plant**: Data regarding average number of leaves per plant under each treatment during the growing period are recorded in Table 2. In the beginning, there were 2 to 3 leaves per plant, but their number continued to increase and the ultimate average ranged between 9.35 and 14.72. The maximum number of leaves per plant was obtained under Treatment B, which appears significantly superior to all the treated and untreated ones.

(*c*) **Average Fresh Weight of Leaves Per Plant**: Leaves of twenty randomly uprooted plants from each treatment at successive stages of growth were weighed separately. The fresh weight of leaves varied markedly among the different treatments (Table 3).

All the treatments (except A) showed a significantly superior response over control. Green weight of leaves under treatment A is 83.5 per cent superior to that of control.

(*d*) **Average Dry Weight of Leaves**: Leaves taken for the fresh weight were dried and weighed for each treatment. It is clear from Table 4 that the highest dry weight of leaves was obtained under Treatment B.

(*e*) **Average Fresh Weight of Bulbs**: Bulbs from the twenty randomly uprooted plants were weighed at successive stages of growth (Table 5). Treated plants were significantly superior to control in this respect. A maximum increase in fresh weight of bulbs was noticed between 105 and 135 days after transplanting. Treatment B, here also, produced the best fresh weight.

This increase in percentage of fresh weight under Treatment B, 135 days after transplanting, was found to be 89.26 per cent (Fig. 6) superior to control.

(*f*) **Average Dry Weight of Bulbs**: The bulbs taken for fresh weight were dried and weighed separately as recorded in Table 5. Treatment B appears most outstanding in this regard as well, while control produced a minimum weight.

A clear and comparative assessment regarding the efficiency of the various treatments can be well had from Figs. 1—6. Fig. 1 depicts the pronounced difference caused in growth of transplants within one month after the initial treament. This initial progress was maintained with respect to height of plants, number of leaves, fresh and dry weight of leaves and bulbs per plant throughout the period of investigation. In the end (Fig. 6) 135 days after transplanting, Treatment B produced the most outstanding and beneficial results.

SUMMARY

The present investigation was carried out to study the possibilities of the use of different starer solutions (dung) ; Ammonium-sulphate mixed with Pot. dihydrogen phosphate, and sodium nitrate ; and 10 and 20 parts per million solutions of indole-acetic acid on the growth and yield of onion. Transplants were treated with regulator solutions for four hours before setting in the field, while starter solutions were applied in the vicinity of roots immediately after transplanting. The treated plants obtained a superior growth and yield than untreated ones. Ammonium sulphate mixed with potassium dihydrogen phosphate applied as starter solution was responsible for maximum increase in the fresh weight of leaves and bulbs (83.5 per cent and 89.26 per cent respectively) over control. Control plants obtained the minimum averages in all respects.

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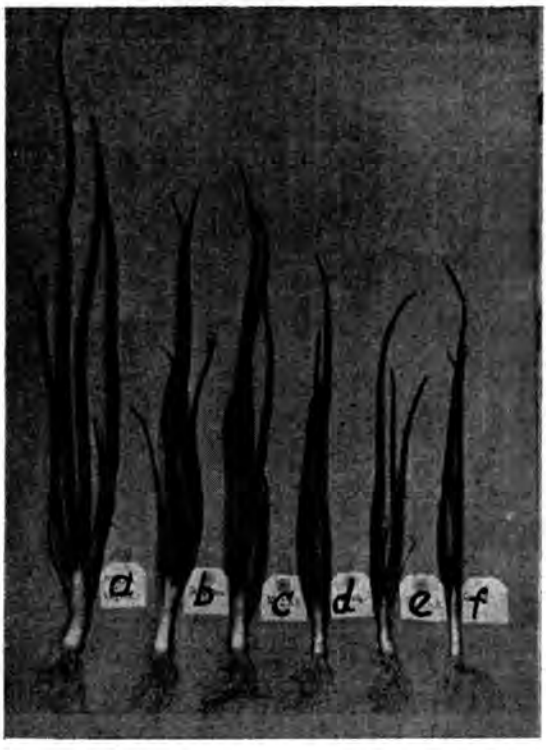

Fig. 1.—Transplants showing the influence of different treatments, 30 days after the initial treatments of— a. Ammonium sulphate mixed with Potassium di-hydrogen phosphate ; b. Dung starter ; c. 10 p.p.m., I.A.A. ; d. Sodium nitrate ; e 20 p.p.m., I.A.A. ; f. Controls.

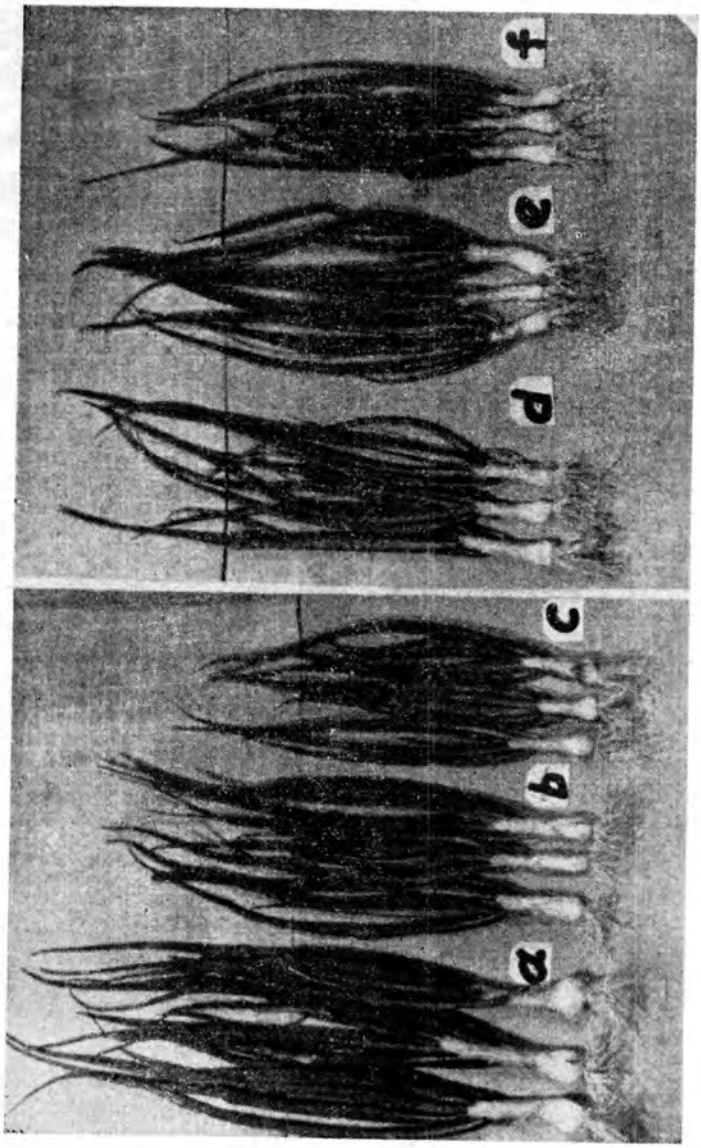

Fig. 2.—Transplants, 45 days after the treatment.

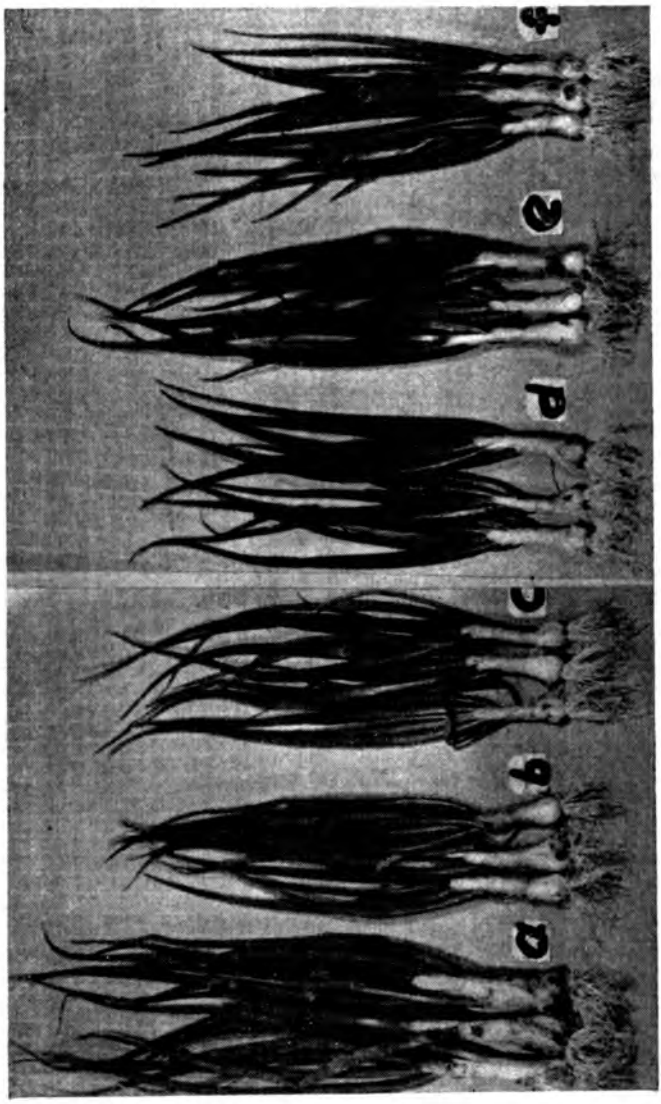

Fig. 3.—Transplants, 60 days after the treatment.

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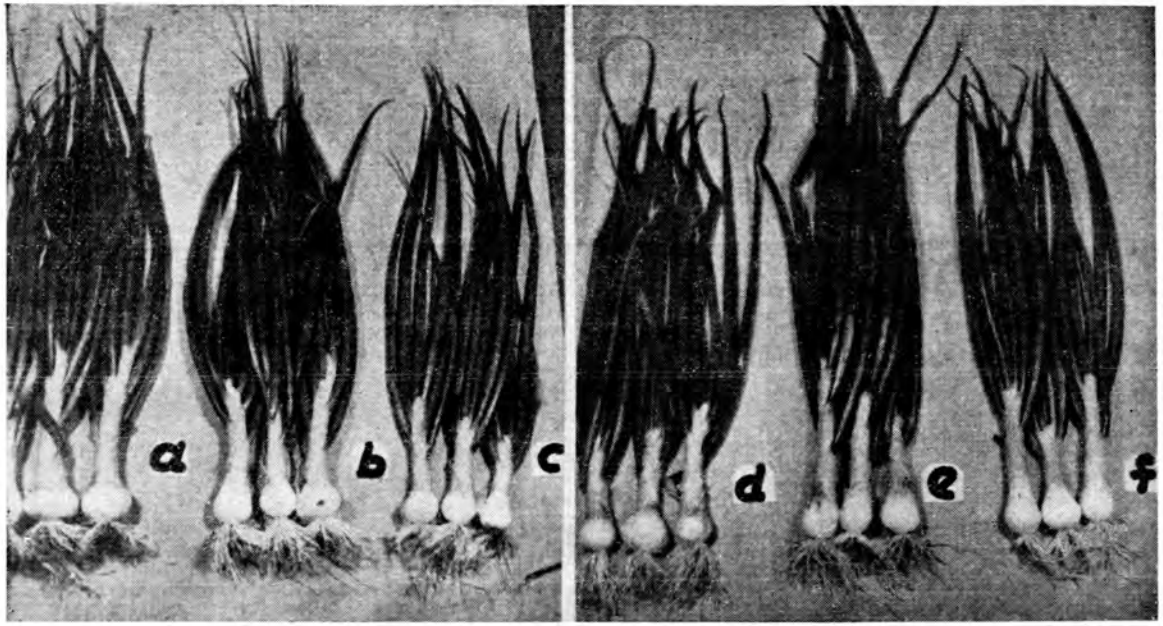

Fig. 4.—Transplants, 90 days after transplanting.

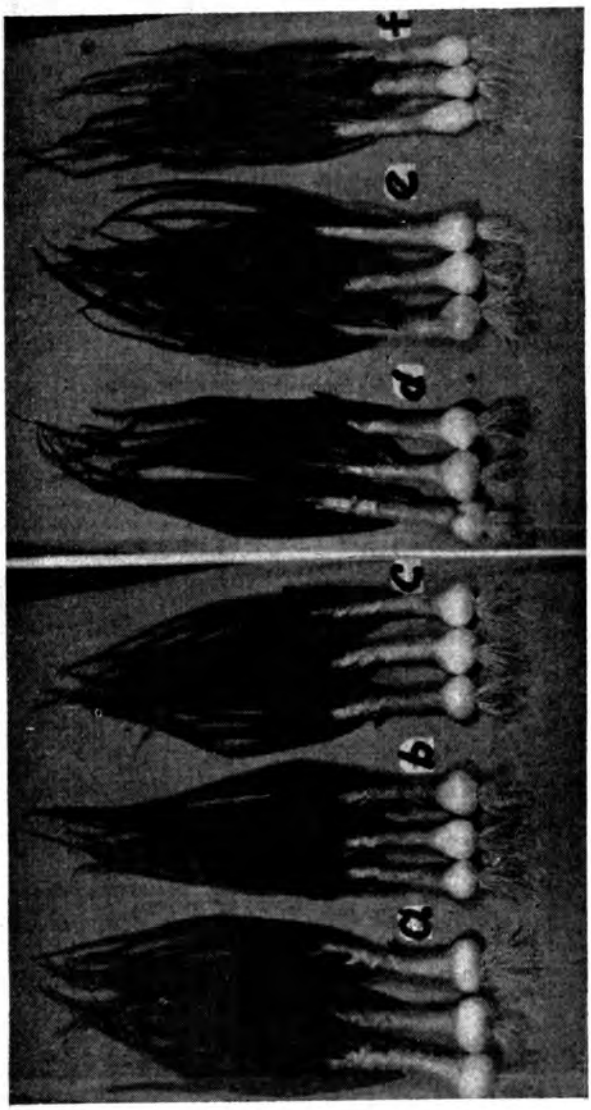

Fig. 5.—Transplants, 120 days after transplanting.

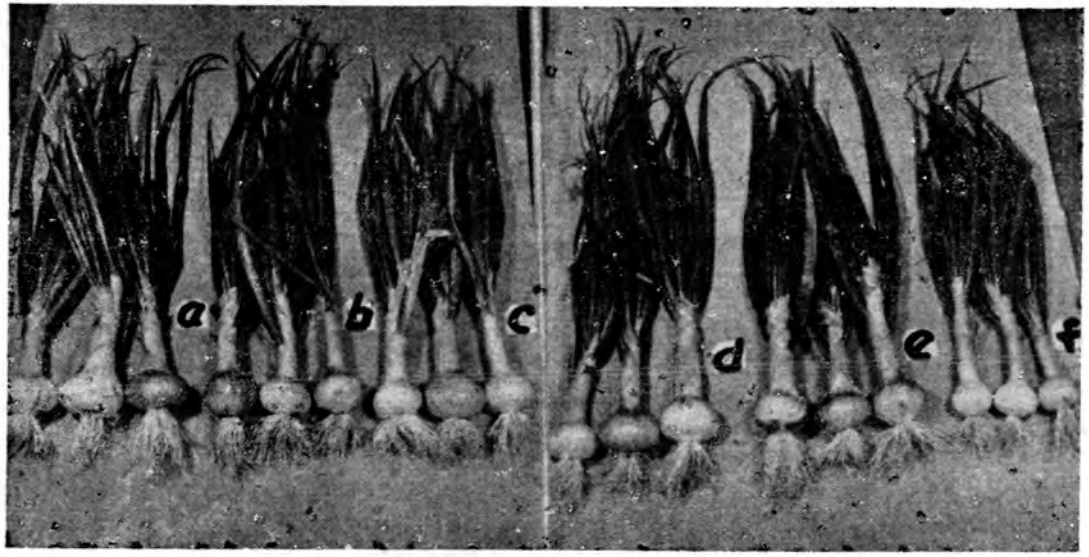

Fig. 6.—Onion plants showing the marked influence of different treatments on the growth and development of foliage and bulbs, 135 days after the initial treatment and the transplanting.

Table 1.—Showing the average height of plants in centimeters at successive periods of growth (Average of 40 plants)

Age in Days after transplanting	*Treatments*					
	A	*B*	*C*	*D*	*E*	*F*
30 ..	9·95	14·00	8·27	9·05	9·42	7·50
40 ..	15·47	22·82	13·05	12·87	13·80	11·70
50 ..	19·72	33·27	17·47	17·97	19·47	14·90
60 ..	37·02	51·65	32·80	35·45	37·35	32·20
70 ..	48·75	61·60	46·70	47·40	48·27	43·82
80 ..	55·32	65·10	56·10	53·20	55·00	50·67
90 ..	62·22	68·65	64·65	59·07	59·55	58·07
100 ..	65·02	71·00	67·52	61·47	62·40	57·55
110 ..	63·42	69·15	65·45	60·87	61·40	56·17
120 ..	61·97	68·05	64·25	59·42	60·50	52·97

C. D. at 5 per cent level = 4·85 (for final observation)

B	C	A	E	D	F
68·05 ..	64·25 ..	61·97 ..	60·5 ..	59·42 ..	52·97

Table 2.—Showing the average number of leaves per plant at successive periods of growth (Average of 40 plants)

Age in days after transplanting	*Treatments*					
	A	*B*	*C*	*D*	*E*	*F*
30 ..	2·57	3·27	2·60	2·47	2·40	2·32
40 ..	3·07	4·37	3·02	3·32	3·17	2·85
50 ..	4·00	5·02	3·95	4·30	4·22	3·42
60 ..	5·25	6·55	5·40	5·75	5·70	4·62
70 ..	6·70	7·50	6·25	6·66	6·42	6·05
80 ..	7·65	9·77	7·62	7·90	7·97	6·95
90 ..	8·50	11·65	8·62	8·66	8·77	7·77
100 ..	9·67	13·05	10·30	10·70	9·72	8·10
110 ..	10·52	14·67	11·05	10·95	10·57	9·50
120 ..	10·57	14·72	11·35	11·80	11·37	9·35

C. D. at 5 per cent. level = 1·02 (for final observation)

B	D	E	C	A	F
14·72 ..	11·80 ..	11·37 ..	11·35 ..	10·57 ..	9·35

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Table 3.—Showing the average fresh weight of leaves per plant in gms. at successive periods of growth (Average of 20 Plants)

Observations on days after transplanting	*Treatments*					
	A	*B*	*C*	*D*	*E*	*F*
30 ..	12·98	24·49	16·35	13·99	15·43	10·465
45 ..	22·055	46·975	28·38	24·275	26·90	19·950
60 ..	39·165	72·415	49·39	37·820	45·78	32·725
75 ..	58·280	90·380	68·975	52·895	60·45	47·945
90 ..	78·360	106·460	88·085	70·235	74·56	50·115
105 ..	86·540	128·175	101·450	81·940	89·87	67·240
120 ..	91·650	150·500	116·880	92·225	118·565	79·200
135 ..	97·620	162·610	126·630	115·800	129·440	88·590

S. E. of difference between treatment means = 5·89
C. D. at 5 per cent level = 12·55
(For final observation)

B	E	C	D	A	F
162·61 ..	129·44 ..	126·63 ..	115·80 ..	97·62 ..	88·59

Table 4.—Showing the average dry weight of leaves per plant in gms. at successive periods of growth (Average of 20 Plants)

Observation on days after transplanting	*Treatments*					
	A	*B*	*C*	*D*	*E*	*F*
30 ..	3·095	5·145	4·12	2·975	3·45	2·57
45 ..	4·930	9·37	5·94	5·575	4·26	3·69
60 ..	6·475	11·405	8·625	6·93	6·625	5·55
75 ..	9·3	12·645	9·775	7·57	8·145	6·515
90 ..	10·34	13.965	11·85	9·975	10·25	7·445
105 ..	11·094	15·84	13·56	11·135	12·54	8·945
120 ..	12·568	20·035	14·476	12·45	14·648	10·84
135 ..	14·32	21·58	16·76	13·57	17·33	12·04

S. E. of difference between treatment means = 0·76
C. D. at 5 per cent level = 1.619
(For final observation)

B	E	C	A	D	F
21·58 ..	17·33 ..	16·76 ..	14·32 ..	13·57 ..	12·04

Table 5.—Showing the average fresh weight per bulb in gms. at successive periods of growth (Average of 20 plants)

Age in days after transplanting	*Treatments*					
	A	*B*	*C*	*D*	*E*	*F*
30 ..	2·675	5·250	3·305	2·760	2·805	2·125
45 ..	6·875	23·835	10·775	7·585	9·805	5·600
60 ..	19·880	48·575	20·125	23·575	28·470	16·725
75 ..	40·845	76·000	38·520	43·350	36·285	26·670
90 ..	49·530	90·250	58·550	52·940	45·480	35·800
105 ..	67·610	128·045	84·175	72·685	78·965	49·775
120 ..	98·345	186·540	128·650	95·484	108·880	76·685
135 ..	137·470	204·270	169·800	156·170	160·470	107·930

C. D. at 5 per cent level = 4·6
(For final observation)

B	C	E	D	A	F
204·27 ..	169·80 ..	160·47 ..	156·17 ..	137·47 ..	107·93

Table 6.—Showing the average dry weight per bulb in gms. at successive periods of growth (Average of 20 bulbs)

Age in days after transplanting	*Treatments*					
	A	*B*	*C*	*D*	*E*	*F*
30 ..	0·55	1·275	0·740	0·610	0·825	0·530
45 ..	1·935	2·275	1·105	1·370	1·525	0·730
60 ..	4·735	7·570	3·240	3·025	3·160	2·475
75 ..	6·305	11·160	7·030	4·950	6·170	3·975
90 ..	7·575	13·950	8·430	6·660	9·450	5·350
105 ..	10·170	19·480	11·846	10·850	12·190	10·175
120 ..	15·660	24·340	17·300	16·250	19·130	13·760
135	22·970	30·620	26·960	24·370	26·430	17·980

C. D. at 5 per cent level = 4·68
(For final observation)

B	C	E	D	A	F
30·62 ..	26·96 ..	26·43 ..	24·37 ..	22·27 ..	17·98