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Synchronization of pod maturity in groundnut by using plant growth regulators and nutrients

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ABSTRACT

Altering the plant metabolism by exogenous plant growth regulators provides various opportunities such as outreaching environmental constraints, improving the quality and aiding desired production. The effect of plant growth regulators and nutrients in synchronization of pod maturity in groundnut variety TMVGn 13 was studied. Experiment comprising eleven treatments which were replicated thrice under RBD design was conducted in the field of Department of Farm Management, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu during 2017-2018. Maximum number of mature pods was obtained from plants sprayed with TNAU groundnut rich + 2 per cent ethephon 50 ppm and ethephon 50 ppm followed by NAA-treated plants.

Keywords: Groundnut; mature pods; plant growth regulators; ethrel

INTRODUCTION

Groundnut (*Arachis hypogaea* L) is an important leguminous oilseed crop and commonly called as poor man's nut. It is the world's 13th most important food crop, 4th most important source of edible oil and 3rd most important source of vegetable protein. Groundnut naturally possesses racemose and indeterminate flowering hence growth and development of its growth phases overlap. This causes low fruiting efficiency due to inter-organ competition for photo-assimilates and other metabolites. Consequently there is improper partitioning of assimilates to the developing pods and seeds at the time of harvest. Most prominent constraint in the low yield is extended duration of flowering and variable pods sizes. Krishnamoorthy (1981) stated that it is possible to increase the yield of groundnut through either increasing or suppressing the flower production using growth regulators.

Generally a large number of early formed flowers develop into fruits and flowers that appear 70 days after sowing, do not form pods and fail to increase the yield (Knauft and Gorbet 1989, Putnam et al 1991). In groundnut time taken from flowering to pod maturity ranges from 55 to 60 days indicating that the early formed flowers alone have a chance to develop into mature pods. Thereby cessation of late forming flowers direct the photosynthates to developing pods thus enhancing more number of mature pods at the time of harvest thus achieving synchronized maturity. Foliar sprays of growth regulating substances have altered the source-sink relationship by diverting the assimilates to the desirable sinks that is more number of filled pods (Sharma and Sardana 2012).

MATERIAL and METHODS

The present study was conducted in the field of Department of Farm Management, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu during 2017-2018. The experiment was laid out in randomized block design with eleven treatments of growth regulating substances and nutrients viz T_1 [Control (without spray)], T_2 (Mepiquat chloride 125 ppm), T_3 (Ethephon 50 ppm), T_4 (Paclobutrazol 60 ppm), T_5 (NAA 200 ppm), T_6 (NAA 300 ppm), T_7 (TNAU groundnut rich 2% + mepiquat chloride 125 ppm), T_8

(TNAU groundnut rich 2% + ethephon 50 ppm), T_9 (TNAU groundnut rich 2% + paclobutrazol 60 ppm), T_{10} (TNAU groundnut rich 2% + NAA 200 ppm), T_{11} (TNAU groundnut rich 2% + NAA 300 ppm). TNAU groundnut rich was sprayed at flowering stage and growth regulators were sprayed 60 days after sowing so as to effectively control the late formed flowers. Each treatment was replicated thrice and ten plants per treatment were taken for study.

Different observations like number of newly formed flowers after spraying, number of pegs and number of mature, immature and ill-filled pods were made. Newly produced flowers after spraying were recorded on daily basis.

RESULTS and DISCUSSION

Number of newly formed flowers after spraying: The foliar spray of T_8 (TNAU groundnut rich 2% + ethephon 50 ppm) and T_3 (Ethephon 50 ppm) recorded the lowest number of flowers (1.24 and 2.67 respectively) 15 days after spraying (DAS) after which there was no flower production as compared to other treatments and control (Table 1). This could be attributed to inhibitory effect of ethephon on late formed flowers. Ketring and Schubert (1980) stated that ethylene inhibited the onset of flowering if applied before beginning of flowering in groundnut. These findings are also in agreement with those of Krishnamoorthy (1972) who found that ethephon spraying before flower induction reduced the number of flowers in groundnut. The effect of ethephon on flowering has also been reported in poinsettia by Faust et al (2001) in almond and Grijalva-Contreras et al (2011).

Number of pegs per plant

Data given in Table 2 indicate that in overall the mean lowest number of peg production per plant was recorded in T_{11} (TNAU groundnut rich 2% + NAA 300 ppm) and T_6 (NAA 300 ppm) (16.65 each) which were on par with T_5 (NAA 200 ppm) (16.78) and T_3 (Ethephon 50 ppm) (17.05). The highest number of peg production per plant was recorded in T_1 [Control (without spray)] (24.13) followed by T_2 (Mepiquat chloride 125 ppm) (21.19). However after 15 days of spray the lowest number of peg production per plant was recorded in T_6 (NAA 300 ppm) (18.30) and highest in T_1 [Control (without spray)] (37.00). This could be attributed to the reduced number of flowers after foliar spray which subsequently reduced number of pegs. This process subsequently results in transportation of the photo-assimilates to pods for better production of mature pods.

Table 1. Effect of PGRs and nutrients on number of newly produced flowers after foliar spray in groundnut cultivar TMVGn 13

Treatment	Newly produced flowers				
	Before spraying (60th day)	After spraying (DAS)			Mean
		15	30	45	
T_1	41.33	20.98	15.15	8.17	21.41
T_2	40.67	22.01	16.18	9.20	22.01
T_3	43.00	2.67	0.56	0.00	11.56
T_4	39.33	20.33	14.50	7.52	20.42
T_5	40.00	12.82	9.98	3.00	16.45
T_6	41.00	11.15	9.08	1.85	15.77
T_7	41.00	21.33	15.50	8.52	21.59
T_8	41.33	1.24	0.00	0.00	10.64
T_9	41.33	19.55	13.72	6.74	20.33
T_{10}	41.33	12.22	9.49	2.51	16.39
T_{11}	41.67	10.92	8.49	1.51	15.65
Mean	41.09	14.11	10.24	4.45	17.47
SEd	0.8556	0.0416	0.0319	0.0176	
$CD_{0.05}$	1.7848	00867	0.0666	0.0367	

*DAS: Days after spraying; T_1: Control (without spray), T_2: Mepiquat chloride 125 ppm, T_3: Ethephon 50 ppm, T_4: Paclobutrazol 60 ppm, T_5: NAA 200 ppm, T_6: NAA 300 ppm, T_7: TNAU groundnut rich 2% + mepiquat chloride 125 ppm, T_8: TNAU groundnut rich 2% + ethephon 50 ppm, T_9: TNAU groundnut rich 2% + paclobutrazol 60 ppm, T_{10}: TNAU groundnut rich 2% + NAA 200 ppm, T_{11}: TNAU groundnut rich 2% + NAA 300 ppm

Table 2. Effect of PGRs and nutrients on number of pegs/plant after foliar spray in groundnut cultivar TMVGn 13

Treatment	Number of pegs/plant				
	Before spraying (60th day)	After spraying (DAS)			Mean
		15	30	45	
T_1	31.7	37.00	21.20	6.60	24.13
T_2	31.0	28.70	19.00	6.10	21.19
T_3	32.0	20.40	12.80	2.90	17.05
T_4	31.0	22.60	16.50	5.60	18.93
T_5	31.0	20.70	10.80	4.60	16.78
T_6	31.0	18.30	14.00	3.40	16.65
T_7	30.7	27.70	17.20	7.60	20.77
T_8	31.1	22.60	14.80	1.20	17.41
T_9	30.7	26.80	15.70	5.11	19.59
T_{10}	30.0	20.80	14.50	3.30	17.15
T_{11}	31.7	21.60	12.60	2.20	16.65
Mean	31.07	24.27	15.38	4.42	24.13
SEd	0.0584	0.0492	0.0395	0.0208	
$CD_{0.05}$	0.1218	0.1026	0.0825	0.0433	

*DAS: Days after spraying; T_1: Control (without spray), T_2: Mepiquat chloride 125 ppm, T_3: Ethephon 50 ppm, T_4: Paclobutrazol 60 ppm, T_5: NAA 200 ppm, T_6: NAA 300 ppm, T_7: TNAU groundnut rich 2% + mepiquat chloride 125 ppm, T_8: TNAU groundnut rich 2% + ethephon 50 ppm, T_9: TNAU groundnut rich 2% + paclobutrazol 60 ppm, T_{10}: TNAU groundnut rich 2% + NAA 200 ppm, T_{11}: TNAU groundnut rich 2% + NAA 300 ppm

Number of mature, immature and ill-filled pods/ plant

The treatment T_8 (TNAU groundnut rich 2% + ethephon 50 ppm) and T_3 (Ethephon 50 ppm) yielded the highest number of mature pods, both double-seeded and single-seeded followed by T_{11} (TNAU groundnut rich 2% + NAA 300 ppm) and T_6 (NAA 300 ppm). Subsequently immature and ill-filled seeds were lower in above mentioned treatments and higher in control followed by T_2 (Mepiquat chloride 125 ppm) (Table 3). The findings are in conformity with the results of Devi et al (2011) in soybean. Similar results were also documented by Bangal et al (1983) in gram and Upadhyay et al (1993) who reported that spray of growth regulators enhanced the number of pods per plant and pod weight.

CONCLUSION

In the present study foliar spray of assorted plant growth regulators and nutrients on groundnut cultivar TMVGn 13 exhibited a transparent result of cessation of flower production thereby redirecting the photosynthates to pod in case of TNAU groundnut rich 2 per cent + ethephon 50 ppm followed by ethephon 50 ppm thus resulting in higher number of mature pods and reduced number of immature pods. Considerable reduced flower production and enhanced production were noticed in TNAU groundnut rich 2 per cent + NAA 300 ppm succeeded by NAA 300 ppm.

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Table 3. Effect of PGRs and nutrients on number of pods (mature, immature and ill-filled) in groundnut cultivar TMVGn 13

Treatment	Number of pods/plant					
	Total	Double-seeded		Single-seeded		Ill-filled
		Mature	Immature	Mature	Immature	
T_1	23.77	9.40	8.40	1.58	2.14	2.25
T_2	15.60	8.36	3.35	1.23	2.21	0.45
T_3	18.67	14.62	0.80	2.16	0.47	0.62
T_4	14.67	7.19	2.44	2.58	1.14	1.25
T_5	15.92	9.41	1.87	1.78	1.61	1.23
T_6	16.93	11.77	2.06	1.53	0.92	0.75
T_7	15.68	8.86	2.84	1.29	2.38	0.31
T_8	20.36	17.35	0.62	1.95	0.25	0.19
T_9	14.89	8.35	3.70	1.08	2.52	0.23
T_{10}	16.20	9.06	1.87	2.61	1.21	0.45
T_{11}	17.29	13.01	1.27	2.13	0.77	0.81
Mean	17.27	10.67	2.66	1.81	1.42	0.78
SEd	0.0430	0.0341	0.0142	0.0129	0.0099	0.0071
$CD_{0.05}$	0.0897	0.0712	0.0295	0.0268	0.0206	0.0148

T_1: Control (without spray), T_2: Mepiquat chloride 125 ppm, T_3: Ethephon 50 ppm, T_4: Paclobutrazol 60 ppm, T_5: NAA 200 ppm, T_6: NAA 300 ppm, T_7: TNAU groundnut rich 2% + mepiquat chloride 125 ppm, T_8: TNAU groundnut rich 2% + ethephon 50 ppm, T_9: TNAU groundnut rich 2% + paclobutrazol 60 ppm, T_{10}: TNAU groundnut rich 2% + NAA 200 ppm, T_{11}: TNAU groundnut rich 2% + NAA 300 ppm

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