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INFLUENCE OF INSECT ATTRACTANTS, MICRONUTRIENTS AND GROWTH REGULATORS ON SEED QUALITY PARAMETERS IN ALFALFA (*MEDICAGO SATIVA* L.)

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SUMMARY

A laboratory experiment was carried out at Seed Quality and Research Laboratory, National Seed Unit, University of Agricultural Sciences, Dharwad during the *Rabi-Summer,* 2010-11. The experiment consisted of 8 treatment combinations involving two insect attractants, A_1- Jaggery solution @ 2% and A_2- Commercial attractant (Bee-Q @ 0.175%), two micronutrients M_1- Boron @ 0.8% and M_2- Molybdenum @ 0.05% and two growth regulators. G_1- Gibberilic Acid (GA_3) @ 50 ppm and G_2- Naphthalene Acetic Acid (NAA) @ 50 ppm. Among the insect attractants sprayed, Bee-Q recorded significantly higher test weight (2.62 g), germination percentage (91.16) and vigour index (1373) sprayed at the time of 50 per cent flowering stage and also showed lower electrical conductivity (0.264 dSm^{-1}). Among the growth regulators sprayed, GA_3 (Gibberilic Acid) @ 50 ppm sprayed showed significantly higher test weight (2.60), germination percentage (92.66) and vigour index (1426) and also recorded lower EC (0.260 dS/m). Application of Molybdenum @ 0.05 per cent as foliar spray recorded significantly higher test weight (2.50 g), germination percentage (90.58) and vigour index (1332) and also recorded lower EC (0.278 dS/m). The interaction effects between insect attractants, micronutrients and growth regulators were found significant. The treatment combination of $A_1M_1G_2$ found significantly superior for seed quality parameters over all other treatment combinations.

Key words : Lucerne, insect attractants, boron, molybdenum, gibberlic acid, naphthalene and seed quality

Lucerne (*Medicago sativa,* L) is popularly known as Alfalfa, rightly called as Queen of forage crops in India, and considered as one of the important forage legumes. It can be grown under wide range of soil conditions throughout the world. Lucerne is a perennial forage legume which normally lives 4-8 years, depending on variety and climate. In Karnataka, there are many forage grasses and legumes in cultivation. Among all the available forage legumes, lucerne is very ideal leguminous forage as it is highly palatable, nutritive, fast growing and it can be grown throughout the year. It is fed to animals as green fodder, dry fodder and also as good hay. Lucerne is very ideal feed for small animals like rabbits and even poultry birds due to high protein content. The crop is rich in protein (13.3-26.6 %), phosphorous (0.14-0.66%), calcium (0.92-2.9%), magnesium (0.11-0.64%), carotene (9.27 mg/100gm) vitamin A and C (Abdul Khalak 1989).

As lucerne crop provides good quality green fodder during the summer months when there is acute shortage of green fodder. There is great demand for its quality seed because farmers generally raise the crop for green fodder and do not produce seed. The availability of quality seed is one of the limiting factors in its rapid spread throughout the country. Seed production in lucerne is undependable and restricted to certain regions. Thus, it is insufficient to meet the seed requirement. Almost 80% of this lucerne seed is being produced only in Madhya Pradesh, Haryana, Punjab and other northern states due to favourable environmental conditions prevailing in these states. The regions of low temperature are most favourable for lucerne seed production (Hazra and Sinha, 1996).

Seed production in lucerne requires high

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dexterity, timeliness and conducive climate conditions. Commercial varieties of lucerne are completely self sterile and require insect pollination to facilitate tripping mechanism. Seed production requires the presence of pollinators when the fields of alfalfa are in bloom. Due to this, seed yield of lucerne crop was 2.2 to 4.5 q/ha. Seed yield of lucerne varies capriciously and affects due to pollination failure. Production of quality seed is one of the major set back in lucerne, as it requires tripping mechanism for pollination. Hence, it is essential to know the influence of insect attractants in improving the seed set percentage, seed yield and quality. Spraying of growth regulators and micronutrients is known to bring rapid changes in metabolic balance of growth and partitioning of assimilates as well as the quantity and quality of desired economic part in lucerne (Hazra and Sinha, 1996). Application of growth regulators and micronutrients for optimistic plant production by modifying the growth development and stress behaviour has increased the quantitative and qualitative yield of lucerne crop. Suitable concentrates of growth regulators applied at appropriate time and stage have increased the seed yield in lucerne (Yadava *et al*. 1984). Hence, there is a need to understand the role of micronutrients and growth regulators in increasing the seed yield and seed quality in lucerne crop. Keeping this in view, the present investigation was carried out.

MATERIALS AND METHODS

The experiment was carried at seed Quality and Research Laboratory National Seed Unit, University of Agricultural Sciences, Dharwad during the **Rabi-summer,** 2010-11.

Pure seed fractions of freshly harvested seeds were used to record the seed quality parameters *viz*., thousand seed weight, germination percentage, root length, shoot length, seed length, seedling dry weight, vigour index and electric conductivity were recorded for analysis. The experiment consisted of 8 treatment involving two insect attractants, A_1- Jaggery solution @ 2% and A_2- Commercial attractant (Bee-Q @ 0.175%), two micronutrients M_1- Boron @ 0.8% and M_2- Molybdenum @ 0.05% and two growth regulators. G_1- Gibberlic Acid (GA_3) @ 50 ppm and G_2- Naphthalene Acetic Acid (NAA) @ 50 ppm. Experiment was laid out in completely randomized design and was replicated. Thousand seeds were counted manually from a sample drawn randomly from each treatment in four replications and weight was recorded in grams. Germination test was carried out by adopting between-paper-method as per the procedures of ISTA (Anon., 1996). The number of normal seedlings were counted on the 14th day (final count) of germination from all the replications. The average of four replications was expressed as germination percentage. Shoot length was measured from collar region of the apex in ten randomly selected 14 days old normal seedlings and the mean was recorded as shoot length in centimeters. The root length between collar region and the tip of root in ten randomly selected 14 days old normal seedlings was measured. The mean was calculated and expressed in centimeters. Ten seedlings selected for measuring shoot and root length were dried in an oven at 85 $^0 \pm 1^0$C for 24 hours and after cooling the weight of the ten seedlings measured and expressed in milligrams. Vigour index was computed by using the following formula suggested by Abdul Baki and Anderson (1973) and expressed in number.

Vigour index = Germination (%) x Shoot length + Root length in cm. Electrical conductivity of seed leachates (EC) was conducted on four replications of five grams seeds of each treatment were weighed upto two decimal places. The seeds were treated with acetone for 30 seconds and were thoroughly washed in distilled water for several times. The seeds were soaked in 25 ml distilled water. Flasks were placed in an incubator at a constant temperature of 25°C ± 1°C for 24 hours. The EC of the leachates was measured in the digital conductivity meter and recorded and expressed in dSm^{-1}. The data collected in respect to various seed quality attributes was analyzed statistically as described by Gomez and Gomez (1984). The critical difference (CD) values were calculated at 5 per cent (P=0.05) probability level where 'F' test was significant. The data on percentage of germination was transformed into arcsine square root percentage values and transferred data was used for statistical analysis (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

The major constraint in lucerne cultivation is the availability of quality seeds for sowing. Successful lucerne seed production involves adequate pollination, mineral nutrition and adjustment of cultural and management practices for local condition. In lucerne, the pollen tube mainly fails to fertilize ovules reason the being in sufficient pollen tube length which cause low seed set and low seed yield. Hence, there is a need of

insect populations to trip the pollination mechanism and improve the seed set. Use of micronutrients plays a specific role in crop growth. The exogenous substances such as crop growth regulators and micronutrients known to bring the metabolite balance of growth and partitioning of assimilates as well as quality and quantity of the desired economic products in crop plants (Hazra and Sinha, 1996). Supply of good quality seeds is an effective means of improving the crop production. Seed quality depends on complex condition evoking the most favourable interaction between the genetic make up of the seed and environment, under which it produced, harvested processed and stored.

The data on test weight, seed germination (%) and seedling dry weight (mg) as influenced by insect attractants, micronutrients and growth regulators spray are furnished in Table 1. In the present investigation 1000 seed weight were significantly higher in the plots sprayed with Bee-Q insect attractants when compared to the Jaggery solution. The increase in test weight might be due to better utilization of resources by the plant producing more number of flowers. 1000 seed weight was higher in case of plots sprayed with GA_3 solution as this stage chemical is very much essential for proper development of seeds. GA_3 act as active sink and mobilize the photosynthates from the source to sink. This is also in confirmation with earlier reports of Manomani *et al*. (2002). The interaction effect for test weight was found significant. The treatment combinations of $A_1M_2G_1$ found significantly superior over the other treatment combinations.

The germination percentage varied significantly due to the influence of insect attractants sprayed at the time of 50 per cent flowering stage. Spraying of Bee-Q insect attractant recorded significantly higher germination percentage (91.16) compared to Jaggery solution. The application of Molybdenum @ 0.05 per cent recorded significantly higher germination percentage compared to Boron @ 0.8 % application. The germination percentage significantly higher with seeds harvested from the plots sprayed with GA_3 solution at the time of 50 per cent flowering stage compared to NAA @ 50 ppm. The foliar application of Gibberilic Acid, Molybdenum and Bee-Q solution exerted a profound influence on seed germination. The interaction effects between the insect attractants and micronutrients exhibited that A_2M_1 (Bee-Q + Boron), A_1G_2 (Jaggery solution + NAA) significantly superior in recording the highest germination percentage. The treatment

TABLE 1
Influence of insect attractants, micronutrients and growth regulators on test weight (g), seed germination % and seedling dry weight (mg) in lucerne cv. RL-88

Treatment	Test weight (g)	Seed germination (%)	Seedling dry weight (mg)
Attractants (A)			
A_1	2.38	88.41 (70.13)*	15.50
A_2	2.62	91.16 (72.74)	17.18
S. Em±	0.01	0.31	0.02
C. D. (P=0.05)	0.03	0.93	0.06
Micronutrients (M)			
M_1	2.50	89.00 (70.66)	16.40
M_2	2.46	90.58 (72.16)	16.28
S. Em±	0.01	0.31	0.02
C. D. (P=0.05)	0.03	0.93	0.06
Growth Regulators (G)			
G_1	2.60	92.66 (74.31)	16.94
G_2	2.41	86.91(68.82)	15.74
S. Em±	0.01	0.32	0.02
C. D. (P=0.05)	0.03	0.96	0.06
Interaction (A x M)			
A_1M_1	2.36	86.66 (68.61)	15.38
A_1M_2	2.41	90.16 (71.75)	15.62
A_2M_1	2.65	91.33 (72.91)	17.43
A_2M_2	2.60	91.00 (72.57)	16.94
S. Em±	0.02	0.44	0.03
C. D. (P=0.05)	0.06	1.32	0.09
Interaction (A x G)			
A_1G_1	2.48	91.00 (72.57)	16.05
A_1G_2	2.29	85.83 (67.92)	14.95
A_2G_1	2.72	94.33 (76.26)	17.84
A_2G_2	2.53	88.00 (69.76)	16.53
S. Em±	0.02	0.44	0.03
C. D. (P=0.05)	0.06	1.32	NS
Interaction ((M x G)			
M_1G_1	2.59	91.33 (72.91)	17.05
M_1G_2	2.41	86.66 (68.61)	15.76
M_2G_1	2.61	94.00 (75.85)	16.84
M_2G_2	2.40	87.13 (69.01)	15.71
S. Em±	0.02	0.44	0.03
C. D. (P=0.05)	0.06	1.33	NS
Interaction (A x M x G)			
$A_1M_1G_1$	2.46	88.00 (69.76)	15.90
$A_1M_1G_2$	2.26	85.33 (67.51)	14.86
$A_2M_1G_1$	2.50	94.00 (75.85)	16.10
$A_2M_1G_2$	2.32	86.33 (68.33)	15.03

contd.

Table 1. contd.

Treatment	Test weight (g)	Seed germination (%)	Seedling dry weight (mg)
$A_1M_2G_1$	2.73	94.66 (76.67)	18.20
$A_1M_2G_2$	2.57	88.00 (69.76)	16.66
$A_2M_2G_1$	2.72	94.00 (75.85)	17.48
$A_2M_2G_2$	2.48	88.00 (69.76)	16.40
S. Em±	0.03	0.62	0.04
C. D. (P=0.05)	0.09	1.86	0.12

*Figures in parenthesis indicate arcsine-transformed values

Insect attractants (A) A_1-Jaggery solution @ 2%
A_2-Commercial attractant (Bee-Q @ 0.175%)

Micronutrients (M) M_1-Boron @ 0.8%
M_2-Molybdinum @ 0.05%

Growth regulators (G) G_1-Gibberlic Acid (GA_3) @ 50 ppm
G_2-Naphthalene Acetic Acid (NAA) @ 50 ppm

combination of $A_1M_2G_1$ found significantly superior over all other treatment combinations. Higher seed quality enhanced by foliar spraying of growth regulators and micronutrients may be attributed to improvement in translocation of assimilate from source to sink, increase the protein and oil percentage, increase in seed index, seed density and sound seed percentage. Application of micronutrients and growth regulators in improvement of laboratory germination may be due to increase in protein and oil content which will provides higher initial energy. These results are in conformity with findings of Vyakaranahal *et al*. (1987) in cotton and Vasudevan *et al*. (2000) in sunflower.

Data on shoot length, root length, seedling vigour index and Electrical conductivity as influenced by insect attractants, micronutrients and growth regulators spray are furnished in Table 2. There were significant differences observed in root length and shoot length due to insect attractants, micronutrients and growth regulators. Significantly higher root and shoot length was noticed in plants sprayed with Bee-Q commercial attractants, Molybdenum and Gibberilic Acid treatments compared to their respective other treatments. All the interaction effects due to these treatment combinations also found significant. The application of insect attractants, micronutrients and growth regulators produced seeds with better quality. The better filling of

TABLE 2

Influence of insect attractants, micronutrients and growth regulators on shoot length (cm), root length (cm), vigour index and electrical conductivity in lucerne cv. RL-88

Treatment	Shoot length (cm)	Root length (cm)	Vigour index	EC (dSm^{-1})
Attractants (A)				
A_1	8.52	5.60	1256	0.289
A_2	9.03	6.07	1373	0.264
S. Em±	0.04	0.02	5.55	0.002
C. D. (P=0.05)	0.12	0.06	16.65	0.006
Micronutrients (M)				
M_1	8.76	5.77	1297	0.76
M_2	8.84	5.90	1332	0.278
S. Em±	0.04	0.02	5.50	0.002
C. D. (P=0.05)	0.12	0.06	16.65	0.006
Growth Regulators (G)				
G_1	9.15	6.21	1426	0.260
G_2	8.44	5.46	1203	0.293
S. Em±	0.04	0.02	5.50	0.002
C. D. (P=0.05)	0.12	0.06	16.65	0.006
Interaction (A x M)				
A_1M_1	8.55	5.59	1227	0.290
A_1M_2	8.58	5.61	1284	0.288
A_2M_1	8.96	5.95	1367	0.262
A_2M_2	9.10	6.19	1379	0.267
S. Em±	0.06	0.03	7.85	0.003
C. D. (P=0.05)	0.18	0.09	NS	0.009
Interaction (A x G)				
A_1G_1	9.00	5.98	1363	0.265
A_1G_2	8.14	5.23	1149	0.313
A_2G_1	9.31	6.44	1490	0.255
A_2G_2	8.75	5.69	1257	0.273
S. Em±	0.06	0.03	7.85	0.003
C. D. (P=0.05)	0.18	0.09	NS	0.009
Interaction (M x G)				
M_1G_1	9.15	6.03	1389	0.258
M_1G_2	8.37	5.51	1205	0.293
M_2G_1	9.16	6.39	1463	0.262
M_2G_2	8.52	5.40	1200	0.293
S. Em±	0.06	0.03	7.85	0.00
C. D. (P=0.05)	0.18	0.09	23.55	0.009
Interaction (A x M x G)				
$A_1M_1G_1$	8.90	5.93	1304	0.263
$A_1M_1G_2$	8.21	5.26	1151	0.317
$A_2M_1G_1$	9.10	6.03	1421	0.267
$A_2M_1G_2$	8.07	5.20	1147	0.310

contd.

Treatment	Shoot length (cm)	Root length (cm)	Vigour index	EC (dSm^{-1})
$A_1M_2G_1$	9.40	6.13	1475	0.253
$A_1M_2G_2$	8.53	5.76	1260	0.270
$A_2M_2G_1$	9.23	6.75	1505	0.257
$A_2M_2G_2$	8.96	5.62	1254	0.277
S. Em±	0.09	0.04	11.10	0.004
C. D. (P=0.05)	0.27	0.12	NS	0.012

Insect attractants (A) A_1- Jaggery solution @ 2%
A_2- Commercial attractant (Bee-Q @ 0.175%)

Micronutrients (M) M_1- Boron @ 0.8%
M_2- Molybdinum @ 0.05%

Growth regulators (G) G_1- Gibberlic Acid (GA_3)@ 50 ppm
G_2- Naphthalene Acetic Acid (NAA) @ 50 ppm

seeds and higher test weight which indicates the better food reserve in the seeds produced with these treatments might have resulted in better quality parameters. These results are in agreements with the observations of Vippin Krishna *et al*. (2006) in lucerne and Sundara (2002) in pea. Significantly higher seedling dry weight, vigour index was observed in the plots sprayed with Bee-Q (insect attractants), Molybdenum (micronutrients), GA_3 (growth regulators). Application of Molybdenum as foliar spray recorded significantly higher vigour index values compared to Boron spray. The vigour index did not vary significantly due to the insect attractants, micronutrients and growth regulators. The better seed quality may be due to spraying of micronutrients and growth regulators resulted in production of bold seeds.

The electrical conductivity exhibited significant differences due to insect attractants, micronutrients and growth regulators. The spraying of Jaggery solution, molybdenum and gibberllic Acid recorded significantly lower electrical conductivity values. The electrical conductivity of the seed leachate is inversely proportional to the seed quality. These results are in conformity with the findings of Vippin Krisha *et al*. (2006) in lucerne. All the interactions found significant for electrical conductivity and the treatment combination $A_1M_1G_2$ recorded higher electrical conductivity and lower was in $A_1M_2G_1$. The increase in electrical conductivity of the seed leachate values could be due to the loss in membrane permeability. However, disruption of membrane permeability may not be same for all the treatments and hence it causes difference in seed quality characters among the treatments.

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