The Bioscan 11(4): 2521-2524, 2016 (Supplement on Agronomy)
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

INTEGRATION OF CULTURAL PRACTICES FOR THE MANAGEMENT OF APHID, *APHIS GOSSYPII* GLOVER INFESTING ISABGOL, *PLANTAGO OVATA* FORSKEL

S. R. PATEL, K. D. SHAH* AND D. M. KORAT
Department of Entomology,
College of Agriculture, Junagadh Agricultural University, Junagadh - 362 001(Gujarat), INDIA
e-mail: kalpit_195@yahoo.com

KEYWORDS
Isabgol
Aphid
Sowing

Received on :
27.06.2016

Accepted on :
15.10.2016

***Corresponding author**

ABSTRACT

Isabgol is one of the most important medicinal plants having tremendous medicinal properties, is grown in India. The present investigation on integration of cultural practices for the management of aphid, *Aphis gossypii* Glover infesting isabgol, *Plantago ovata* Forskel. was undertaken to reduce the usage of pesticides and enhance the organic farming in isabgol. The data indicates that line- sown isabgol crop at 30 cm spacing was less infested (2.60 aphids/plant) as compared to broadcasted crop (3.64 aphids/plant). Aphid population was found to increase with increasing levels of nitrogenous fertilizer. Least numbers of aphids (2.68/ plant) were observed at minimum dose of nitrogen (N1).Significantly higher seed yield (7.90 q/ha) was recorded in the line sown crop as compared to broadcasted crop (5.03 q/ha).

INTRODUCTION

Medicinal plants are the local heritage with global importance, world is endowed with a rich wealth of medicinal plants. It is also considered as a wealthy source for earning foreign exchange. Isabgol is one of these medicinal crops having multiple benefits related to intestinal problems and bringing a handsome foreign exchange to the country. Among various limiting factors in successful production of the crop, the aphids, *Aphis gossypii* Glover (Aphididae: Hemiptera) has been reported as major insect pest attacking on isabgol crop (Sagar and Jindla, 1984). It has a broad host range of hosts and causes both direct as well as indirect damage resulting in both qualitative and quantitative loss. Isabgol, being a medicinal crop, the use of persistent insecticides for control of aphid is not advisable. Therefore non- chemical measures are the alternatives to avoid the use of chemical pesticides.Among the various non- chemical measures, the impact of sowing method on incidence of aphid, *A. gossypii* infesting isabgol has been tried by Patel (2002). Nitrogenous fertilizers applied to the crop greatly influence the sucking pest population Bansode and Purohit (2013), Prasad *et. al*. (2014). Plant density has been found to play role in pest population buildup. Keeping this view in mind an attempt was made to investigate the impact of sowing methods and nitrogenous fertilizers on aphid, *A. gossypii* infesting isabgol.

MATERIALS AND METHODS

In order to study the impact of sowing methods and nitrogenous fertilizers on aphid infesting isabgol, a field experiment was conducted at Medicinal and Aromatic Farm of Anand Agricultural University, Anand (Gujarat) during *rabi* 2013 and 2014. The experiment was carried out in Randomized block design (factorial) and replicated thrice. Gross and net plot size was 3.5 X 2.1$m^2$and 2.0 X 1.5m^2, respectively. Seed of isabgol variety "Gujarat isabgol-2" were sown by two different methods *viz*., Broadcasting (S_1) and line sowing (S_2) [at 30 cm distance]. The crop was sown during first fortnight of December in both the years of investigation with adding four different doses ($N_1 = 25$, $N_2 = 30$, $N_3 = 35$ and $N_4 = 40$ kg N/ha) of nitrogenous fertilizers. The half dose of nitrogenous and full dose of phosphorous was given at the time of sowing as basal application, while remaining half dose of nitrogen was applied one month after sowing.

In order to record the aphid population, five plants were selected randomly from each net plot area and tagged. Number of aphids present on three spikes of each tagged plant was recorded as per the method followed by Sagar *et al*. (1987) and Patel (2002). Based on these data, mean number of aphids/ spike was worked out. The observations were recorded at weekly interval starting from initiation of aphid incidence and continued up to harvest of the crop. All the experimental plots were kept free from any insecticide application.Yields from individual net plot were recorded separately at harvest. The data on number of aphids population were subjected to ANOVA after transforming them into square root while, the data on yields were analyzed without transformation.

Sowing methods: (S_1) broadcasting and (S_2) line sowing at 30 cmalong with four different levels of nitrogenous fertilizer : (N_1) 25 Kg N/ha, (N_2) 30 Kg N/ha, (N_3) 35 Kg N/ha and (N_4) 40

Kg N/ha, respectively were evaluated to ascertain their impact on the incidence of *Aphis gossypii* at during *rabi* 2013 and 2014.

RESULTS AND DISCUSSION

Data evaluated in present experiment (Table 1) indicated that the aphid population recorded at 7 weeks after sowing (WAS) did not reveal any significant variation in both the methods of sowing i.e. broadcasting and line sowing, however relatively more number of aphids were recorded in former treatment than the latter. Aphid population recorded from 8th to 12th WAS showed significant difference between both the methods of sowing. Significantly greater numbers of aphids were recorded in the plots where isabgol seeds were broadcasted in comparison to line sowing. Pooled over period data computed for first year indicated that significantly highest (13.79 aphids/spike) population of aphid was registered in the crops sown by broadcasting method than the line sowing (7.91 aphids/spike).

In subsequent year of experimentation, (Table 2) there was significant difference in aphid numbers recorded in both the main treatments of sowing methods.The treatment of broadcasting seeds exhibited aphid population ranging from 3.70 to 28.66 aphids/ spike as against 1.06 to 15.74 aphids/ spike in line sowing method. Pooled over period data worked out for the year 2014 showed higher incidence of aphid (11.72 aphids/ spike) in the plots of broadcasting method of sowing over the plots of line sowing (4.79 aphids/ spike).

Overall pooled (pooled over periods and years) data (Table 3) clearly indicated that the treatment of broadcasting exhibited higher (12.75 aphids/ spike) population of aphid than the treatment of line sowing which registered 6.26 aphids/ spike.

From these results, it inferred that sowing method by broadcasting the isabgol seeds provided congenial conditions and favored for multiplication of aphids which might has resulted in higher population of the pest, whereas line sowing exhibited lower population of aphids. This finding is in agreement with the report of Patel and Borad (2005) who concluded that broadcasted isabgol crop suffered heavily due to the aphid, *A. gossypii*, whereas the crop sown by line-sowing found relatively less infested by the pest.Except this solitary report, none of the earlier worker has studied the impact of sowing methods on aphids infesting isabgol crop. However, few researchers in past have documented the higher incidence of sucking pests in narrow spacing/ high plant density than the wider spacing/ low plant density. Abd EL-Malak and Salem (2002) found that the sucking pests were abundant on sweet potato with narrow spacing treatment than the wider spacing.

Kalaichelvi (2008) observed more population of aphids and hoppers in *Bt* cotton in closer plant spacing of 90 x 45 cm than 90 x 60 and 120 x 60 cm. According to Sarwar (2008), the mustard aphid, *Lipaphis erysimi* (Kalt.) population increased significantly as the inter row spacing decreased. These reports are in the line of present finding.

In case of nitrogenous fertilizer application aphid, *A. gossypii* (Table 1) recorded in different plots received with varying level of nitrogen indicated that maximum population of aphid (14.79 aphids/ spike) was found in plots wherein highest dose of nitrogen was applied followed by the treatment of 35 Kg N/ ha (10.99 aphids/spike). The treatment of 40 Kg N/ha registered significantly higher population of aphid in comparison to the treatments of 25 and 30 Kg N/ha, whereas the treatment of 35 Kg N/ha found at par with these treatments. Pooled data (Table 2) computed for the second year (2014) indicated that the

Table 1: Effect of sowing methods and different regimes of nitrogenous fertilizers on aphid infesting isabgol during 2013

Treatments	Number of aphids/ spike at different intervals (Weeks after sowing)						
	7th	8th	9th	10th	11th	12th	Pooled
Sowing (S) S_1	1.43*(1.54)	2.96(8.26)	5.11(25.61)	4.39(18.77)	5.18(26.33)	3.58(12.32)	3.78b(13.79)
S_2	1.37(1.38)	2.68(6.68)	2.98(8.38)	3.97(15.26)	3.60(12.46)	2.79(7.28)	2.90a(7.91)
S.Em. +	0.04	0.05	0.08	0.07	0.07	0.04	0.02
C.D. at 5 %	NS	0.15	0.23	0.20	0.20	0.13	0.07
Nitrogen levels (N) N_1	1.46(1.63)	2.24(4.52)	3.87(14.48)	3.54(12.03)	3.36(10.79)	3.15(9.42)	2.94a(8.14)
N_2	1.49(1.72)	2.87(7.74)	3.55(12.10)	4.00(15.50)	3.96(15.18)	2.82(7.45)	3.12b(9.23)
N_3	1.44(1.57)	3.27(10.19)	4.30(17.99)	4.20(17.14)	4.36(18.51)	2.74(7.01)	3.39c(10.99)
N_4	1.22(0.99)	2.91 (7.97)	4.46(19.39)	4.97(24.20)	5.89(34.19)	4.02(15.66)	3.91d(14.79)
S.Em. +	0.06	0.07	0.11	0.10	0.09	0.06	0.03
C.D. at 5 %	0.16	0.21	0.32	0.29	0.28	0.18	0.10
ANOVA							
S.Em. +P	-	-	-	-	-	-	0.04
P x S	-	-	-	-	-	-	0.06
P x N	-	-	-	-	-	-	0.09
S x N	0.08	0.10	0.16	0.14	0.13	0.09	0.05
P x S x N	-	-	-	-	-	-	0.12
C.D. at 5 % P	-	-	-	-	-	-	0.12
P x S	-	-	-	-	-	-	0.17
P x N	-	-	-	-	-	-	0.24
S x N	0.23	0.30	0.46	0.41	0.39	0.26	0.14
P x S x N	-	-	-	-	-	-	0.34
C. V. (%)	11.09	7.24	7.70	6.60	6.06	5.46	7.26

*Figures are $\sqrt{x + 0.5}$ transformed values whereas those in parentheses are re-transformed values; Treatment means with letter(s) in common are not significant by lsd at 5 % level of significance; NS: Non significant

Table 2: Effect of sowing methods and different regimes of nitrogenous fertilizers on aphid infesting isabgol during 2014

Treatments	Number of aphids/ spike at different intervals (weeks after sowing)						
	7th	8th	9th	10th	11th	12th	Pooled
Sowing (S) S_1	2.37(5.12)	4.58(20.48)	5.40(28.66)	3.72(10.19)	2.92(8.03)	2.05(3.70)	3.51b(11.72)
S_2	1.32(1.24)	3.27(10.19)	4.03(15.74)	2.16(4.17)	1.75(2.56)	1.25(1.06)	2.30a(4.79)
S.Em. +	0.04	0.12	0.09	0.07	0.05	0.05	0.02
C.D. at 5 %	0.13	0.35	0.27	0.20	0.15	0.16	0.07
Nitrogen levels (N) N_1	1.57(1.96)	3.59(12.39)	3.99(15.42)	2.43(5.40)	1.79(2.70)	1.19(0.92)	2.43a(5.40)
N_2	1.89(3.07)	4.40(18.86)	4.85(23.02)	2.35(5.02)	1.97(3.38)	1.34(1.30)	2.80b(7.34)
N_3	2.08(3.83)	3.60(12.46)	5.26(27.17)	3.19(9.68)	2.60(6.26)	1.91(3.15)	3.11c(9.17)
N_4	1.85(2.92)	4.12(16.47)	4.78(22.35)	3.79(13.86)	2.97(8.32)	2.16(4.17)	3.28d(10.26)
S.Em. +	0.06	0.17	0.13	0.10	0.08	0.08	0.03
C.D. at 5 %	0.18	0.49	0.38	0.29	0.22	0.23	0.10
ANOVA							
S.Em. +P	-	-	-	-	-	-	0.06
P x S	-	-	-	-	-	-	0.08
P x N	-	-	-	-	-	-	0.11
S x N	0.08	0.24	0.18	0.14	0.11	0.11	0.05
P x S x N	-	-	-	-	-	-	0.16
C.D. at 5 % P	-	-	-	-	-	-	0.16
P x S	-	-	-	-	-	-	0.22
P x N	-	-	-	-	-	-	0.31
S x N	0.26	0.69	0.54	0.41	0.31	0.32	0.14
P x S x N	-	-	-	-	-	-	0.44
C. V. (%)	9.57	11.99	7.72	9.43	9.06	13.12	10.84

*Figures are $\sqrt{x+0.5}$ transformed values whereas those in parentheses are re-transformed values; Treatment means with letter(s) in common are not significant by lsd at 5 % level of significance

Table 3: Effect of sowing methods and different regimes of nitrogenous fertilizers on aphid infesting isabgol (Pooled)

Treatments	Mean number of aphids/ spike		
	2013	2014	Pooled
Sowing (S) S_1	3.78b(13.79)	3.51b(11.72)	3.64(12.75)
S_2	2.90a(7.91)	2.30a(4.79)	2.60 (6.26)
S.Em. +	0.02	0.02	0.12
C.D. at 5 %	0.07	0.07	NS
Nitrogen levels (N) N_1	2.94a(8.14)	2.43a(5.40)	2.68a(6.68)
N_2	3.12b(9.23)	2.80b(7.34)	2.96ab(8.26)
N_3	3.39c(10.99)	3.11c(9.17)	3.25bc10.06)
N_4	3.91d(14.79)	3.28d(10.26)	3.59c(12.39)
S.Em. +	0.03	0.03	0.08
C.D. at 5 %	0.10	0.10	0.37

ANOVA	S. Em. ±	C. D. @5 %	S. Em. ±	C. D. @5 %	S. Em. ±	C. D. @5 %
Y	-	-	-	-	0.02	0.05
P	0.40	0.12	0.06	0.16	0.67	NS
P x S	0.06	0.17	0.08	0.22	0.29	NS
P x N	0.09	0.24	0.11	0.31	0.24	NS
S x N	0.05	0.14	0.05	0.14	0.21	NS
Y x S	-	-	-	-	0.02	0.07
Y x P	-	-	-	-	0.05	0.14
Y x N	-	-	-	-	0.03	0.10
Y x S x N	-	-	-	-	0.05	0.14
Y x N x P	-	-	-	-	0.10	0.28
Y x S x P	-	-	-	-	0.07	0.20
P x S x N	0.12	0.34	0.16	0.44	0.47	NS
Y x S x N x P	-	-	-	-	0.14	0.39
C. V. (%)	7.26	10.84	9.00			

Note: *Figures are $\sqrt{x+0.5}$ transformed values whereas those in parentheses are re-transformed values; Treatment means with letter(s) in common are not significant by lsd at 5 % level of significance; NS = Not significant

plots received with 40 Kg N/ha exhibited maximum population of aphids (10.26 aphids/spike) followed by the plots received with 35 (9.17 aphids /spike), 30 (7.34 aphids/spike) and 25 (5.40 aphids/spike) Kg N/ha. The former treatment differed significantly from 25 and 30 Kg N/ha by registering significantly higher population of aphids. Both the lower doses of

Table 4: Impact of methods of sowing and nitrogen levels on isabgol seed yield

Treatments	Seed yield (q/ha)		
	2013	2014	Pooled
S_1	5.10b	4.95b	5.03b
S_2	8.36a	7.44a	7.90a
S. Em. +Sowing (S)	0.22	0.16	0.14
C.D. at 5% (S)	0.64	0.47	0.39
N_1	7.68a	7.57a	7.63a
N_2	7.21ab	6.54a	6.88b
N_3	6.60b	5.80b	6.20c
N_4	5.43c	4.87c	5.15d
S. Em. +Nitrogen (N)	0.31	0.23	0.19
C.D. at 5% (N)	0.90	0.67	0.54
ANOVA			
S. Em. +Year (Y)	-	-	0.14
S x N	-	-	0.27
Y x S	-	-	0.19
Y x N	-	-	0.27
Y x S x N	-	-	0.38
C.D. at 5% (Y)	-	-	0.39
S x N	-	-	NS
Y x S	-	-	NS
Y x N	-	-	NS
Y x S x N	-	-	NS
C. V. (%)	12.87	10.37	11.80

Note: Figures are $\sqrt{x+0.5}$ transformed values whereas those in parentheses are re-transformed values. Treatment means with letter(s) in common are not significant by lsd at 5 % level of significance; NS = Not significant

nitrogenous fertilizer exhibited aphid population more or less same numbers.

Overall pooleddata (Table 3) indicated that least numbers of aphids (6.68 aphids/spike) were registered in plots received with lowest dose (25 Kg N/ha) of nitrogen followed by lower dose (30 Kg N/ha). On the other hand maximum number of aphid counts (12.39 aphids/spike) were found in plots received with highest dose (40 Kg N/ha) of nitrogen followed by its subsequent lower dose (35 Kg N/ha). Plots received with nitrogen ranging from 25 to 30 Kg N/ha registered significantly lower incidence of aphids in comparison to highest (40 Kg N/ha) dose. Data clearly revealed that aphid population in isabgol crop increased with the increase in levels of nitrogenous fertilizer.

From the above results, it can be concluded that there was positive association between aphid incidence and nitrogenous fertilizer applied to isabgol crop. It was increased with increasing the levels of nitrogenous fertilizer and vice-versa. Higher doses of nitrogenous fertilizer make the plant tissue more succulent which create favorable conditions for feeding by the aphid. Moreover, nitrogenous fertilizer exerts the luxurious growth in plants which became more attractive to insects. This perhaps is the reason for increasing the population of aphids in isabgol crop. The present findings could not be compared and discussed due to lack of such review in isabgol crop from available source of literature. As stated earlier, there is no report available on impact of nitrogenous fertilizer on population of aphid infesting isabgol. However, few earlier workers have already documented the higher population of aphids due to the higher levels of nitrogenous fertilization in various crops such as cotton (Godfrey *et al.* 2000 and Nevo and Moshe, 2001), *Cosmos* (Almaicoshi *et al.* 1997), mesta (Nakat *et al.* 2002) and potato (Singh *et al.* 2005).

Sowing methods has great impact on seed yield of isabgol crop as it evident from the yield data recorded during 2013 and 2014 (Table 4). Pooled data showed that the isabgol crop raised by line sowing produced significantly higher (7.90 q/ha) seed yield when compared to broadcasting (5.03 q/ha). Further significantly maximum (7.63 q/ha) yield was obtained from the plots received with minimum dose of nitrogen (25 Kg N/ha) than the other doses. On the other hand, minimum yield (5.15 q/ha) was registered with highest dose (40 Kg N/ha) of nitrogenous fertilizer. The experimental results concluded that the application of nitrogenous fertilizers to isabgol crop had positive influence on aphid, *A. gossypii* and negative association with seed yield.

REFERENCES

Abd El-Malak, V. S. G. and Salem, A. A. 2002. Influence of planting spaces and hybrids on the population of six arthropods attacking sweet potato plant. *Ann. Agric. Sci.* **40(3):** 1797-1806.

Almaicoshi, A. A., Aldryhim, Y. N. and Alsuhaibani, A. 1997. Effects of different rates of nitrogenous fertilization and irrigation on population density of *Aphis gossypii* Glover on two ornamental plants. *Arab J. Pl. Prot.***15(1):** 10-15.

Bansode, G. M. and Purohit, M. S. 2013. Effect of different level of nitrogenous fertilizer on larval and post larval development of *Plutella xylostella* (linn.) infesting cauliflower. *The Bioscan.* **8(2):** 545-548.

Godfrey, L. D., Cisneros, J. J., Keillor, K. E. and Hutmacher, R. B. 2000. Influence of cotton nitrogen fertility on cotton aphid, *Aphis gossypii,* population dynamics in California. Proceedings Beltwide Cotton Conferences, held at San Antonio, USA, during 4-8 January. **2:**1162-1165.

Kalaichelvi, K. 2008. Effect of plant spacing and fertilizer levels on insect pests in *Bt* cotton hybrids. *Indian J. Ent.* **70(4):** 356-359.

Nakat, P. G., Giri, D. G., Kubde, K. J., Shingrup, P. V. and Mali, R. S. 2002. Incidence of aphids in mesta under different nitrogen levels. *Ann. Plant Physiol.* **16(2):** 198-199.

Nevo, E. and Moshe, C. 2001. Effect of nitrogen fertilization on *Aphis gossypii* variation in size, colorand reproduction. *J. Eco. Ent.* **94(1):** 27-32.

Patel, H. M. 2002. Bio-ecology and management of *Aphis gossypii* Glover infesting medicinal crop isabgol, *Plantago ovate* Forskel.M.Sc. (Agri.) thesis submitted to Gujarat Agricultural University, Sardarkrushinagar.

Patel, H. M. and Borad, P. K. 2005. Impact of sowing periods and methods on incidence of *Aphis gossypii* infesting isabgol. *J. Med. Aro. Pl. Sci.* **27(2):** 262-264.

Prasad Singha, Supriya Biswas and Sajal Pati 2014. Effects of nitrogenous fertilizer on pest infestation and yield of protected and unprotected okra crop. *The Ecoscan.* **8(1&2):** 168-171.

Sagar, P. and Jindla, L. N. 1984. An outbreak of the aphid, *Aphis gossypii* Glover on isabgol, *Plantago ovata* (L.) and its chemical control. *Intl. Pest Control.* **26(3):** 76-77.

Sagar, P., Jindla, L. N. and Mehta, S. K. 1987. Field screening of isabgol (*Plantagoovata* Linn.) against aphid, *Aphis gossypii* Glover in Punjab. *J. Res. PAU.* **24(3):** 441-444.

Sarwar, M. 2008. Plant spacing - a non-polluting tool for aphidmanagement in canola, *Brassica napus*. *J. Entol. Soc. Iran.* **27(2):** 13-22.

Singh, K. I., Singh, L. N. and Singh, M. P. 2005. Influence of five nitrogen levels with or without *Azatobacter* on the incidence of *Aphis gossypii* Glover in potato. *Indian J. Ent.* **67(2):** 165-169.