



Science

## **EFFECT OF SOWING DATES ON THE TOBACCO CATERPILLAR [*Spodoptera litura* (FABRICIUS)], POPULATION, LEAF DAMAGE AND YIELD OF GROUNDNUT**

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### **Abstract**

The effect of sowing date of groundnut on the population buildup of tobacco caterpillar, *Spodoptera litura* (Fab.) and its effect on leaf damage (%) and yield was studied at the Agricultural Research Farm of the Banaras Hindu University, Varanasi, Uttar Pradesh, India during rainy season consecutively for three cropping years. The tobacco caterpillar average population and groundnut leaf damage (%) was found maximum in the groundnut crop sown on 20th July followed by 5th July and 20th June during all the three years of study. The first infestation of tobacco caterpillar was observed at 45 days after sowing which disappeared 135 days after sowing. The interaction effect of sowing dates and the periods of observation on the leaf damage was found significant. The yield recorded from groundnut crop sown on 20th June was found maximum while the crop sown on 20th July recorded minimum yield.

**Keywords:** Groundnut; Leaf Damage; Population; Sowing Date; Tobacco Caterpillar; Yield.

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### **1. Introduction**

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop which occupies first place in India in respect of acreage and production. It is grown under wide range of soil and climatic conditions in different states of India. About 90 per cent of the groundnut is grown under rain fed condition (Reddy, 1988). The cultivation of improved varieties plays a pivotal role in increasing the production of crops but, at the same time, it also invites a wide spectrum of insect pests. About 100 species of insect pests are known to feed on groundnut and about a dozen are of economically important (Reddy, 1988). Nath and Singh (1998a) have listed 38 species of insect pests infesting groundnut crop at Varanasi. They have further reported that Insect pests causes

severe damage to the crop and contributes significantly in minimizing the productivity of the crop. Most of the pesticides that are used in cotton, rice, pulses, oilseeds and vegetable crops had shown ill effects on human health and environment (Raghunathan, 1996). Different strategies have to be involved for keeping the pest in check and stabilizing the productivity of the cropping system. Date of sowing is one of the crop habitat diversifications that are to be looked into, to minimize the incidence of insect pests on groundnut crop so that its yield can be enhanced. The date of planting takes advantage of the absence of the pest or avoids susceptible stage of the crop. It prevents carryover of pests from early sown crop to late sown crop and prevents buildup of damaging populations (Singh, 1999). Kathryn *et al*, (2014) reported on the basis of their experiment that sowing dates can be used as a pest control measure against insect pests of chilli, it is concluded that early sowing (January 15th or January 30th) resulted in low incidence of aphids, thrips, jassids, whitefly and fruit borer except mites. Such low level of insect pest caused less crop injury which resulted in enhancing green pod yield of chilli. Keeping these facts in view, the effect of sowing dates of groundnut on the population of tobacco caterpillar, *Spodoptera litura* (Fab.), and its effect on leaf damage and yield of groundnut was studied.

## 2. Materials and Methods

Field experiment was conducted at the Agriculture Research Farm, Banaras Hindu University, Varanasi, Uttar Pradesh, India following Randomized Block Design with three sowing dates as treatments and six replications. The groundnut cultivar 'Chitra' was grown following recommended cultivation practices and sowing was done maintaining 20 cm x 40 cm plant to plant and row to row distance on 20<sup>th</sup> June, 5<sup>th</sup> July and 20<sup>th</sup> July during rainy season consecutively for three years. The first hand hoeing and weeding was done three weeks after sowing and thereafter before commencement of flowering. No plant protection measures were exercised during the period of field experimentation.

The experimental crop was monitored on regular basis for incidence of insect pest and the observations were recorded by observing one-meter row length as soon as the infestation of tobacco caterpillar was noticed in the field and thereafter at fortnightly interval. The tobacco caterpillar population data were transformed as  $\sqrt{x+0.5}$  while Arc sine transformation was followed in case of groundnut leaf damage (%) data. The transformed data of tobacco caterpillar population and groundnut leaf damage and original yield data (q/ha) were analyzed for testing the significance of difference.

## 3. Results and Discussion

The population of tobacco caterpillar recorded in the groundnut crop sown on 20<sup>th</sup> June, 5<sup>th</sup> July and 20<sup>th</sup> July during different years of study differed significantly. The population of tobacco caterpillar was maximum in the groundnut crop sown on 20<sup>th</sup> July and minimum in the 20<sup>th</sup> June sown crop. The groundnut crop sown on 5<sup>th</sup> July exhibited medium range of pest population (Table 1). The interaction effect of sowing time and period of observation showed significant effect on the population of tobacco caterpillar during all three years of study.

Table 1: Effect of date of sowing on the population of tobacco caterpillar [*Spodoptera litura* (Fab.)] (average of three years)

Date of Sowing	Population (per metre row length) DAS							
	45	60	75	90	105	120	135	Average
20 <sup>th</sup> June	2.7 (1.7)	3.8 (2.0)	4.9 (2.3)	4.7 (2.2)	4.1 (2.1)	3.1 (1.8)	1.6 (1.4)	3.5 (1.9)
5 <sup>th</sup> July	1.9 (1.5)	3.8 (2.0)	5.5 (2.4)	5.6 (2.4)	5.3 (2.3)	3.8 (1.9)	2.3 (1.6)	4.0 (2.0)
20 <sup>th</sup> July	1.5 (1.3)	3.9 (2.0)	6.8 (2.6)	7.5 (2.8)	6.7 (2.6)	4.9 (2.3)	2.7 (1.7)	4.8 (2.2)
Average	2.0 (1.5)	3.8 (2.0)	5.7 (2.4)	5.9 (2.5)	5.4 (2.4)	3.9 (2.0)	2.2 (1.6)	4.1 (2.0)
Difference between population observed in groundnut crops sown on different dates							C. D. (P = 0.05) = 0.1	
Difference between population observed at different periods of observation							C. D. (P = 0.05) = 1.1	
Interaction between population observed in groundnut crops sown on different dates x periods of observation							C. D. (P = 0.05) = 1.2	

Figures in parentheses are transformed as  $\sqrt{x+0.5}$  ; DAS = Days after sowing.

The population of tobacco caterpillar was recorded for the first time at 45 days after sowing (DAS) and after attaining the peak population at 75 DAS, 105 DAS and 90 DAS showed declining trend during 2<sup>nd</sup>, 1<sup>st</sup> and 3<sup>rd</sup> years respectively and disappeared after 135 DAS in all the three years of study (Fig. 1). The overall tobacco caterpillar population in all the three dates sown crops showed higher population during 3<sup>rd</sup> year followed by 2<sup>nd</sup> and 1<sup>st</sup> years. However, the average population was maximum in 5<sup>th</sup> July sown crop followed by 20<sup>th</sup> June and 20<sup>th</sup> July sown crops during different years of study (Fig.2).

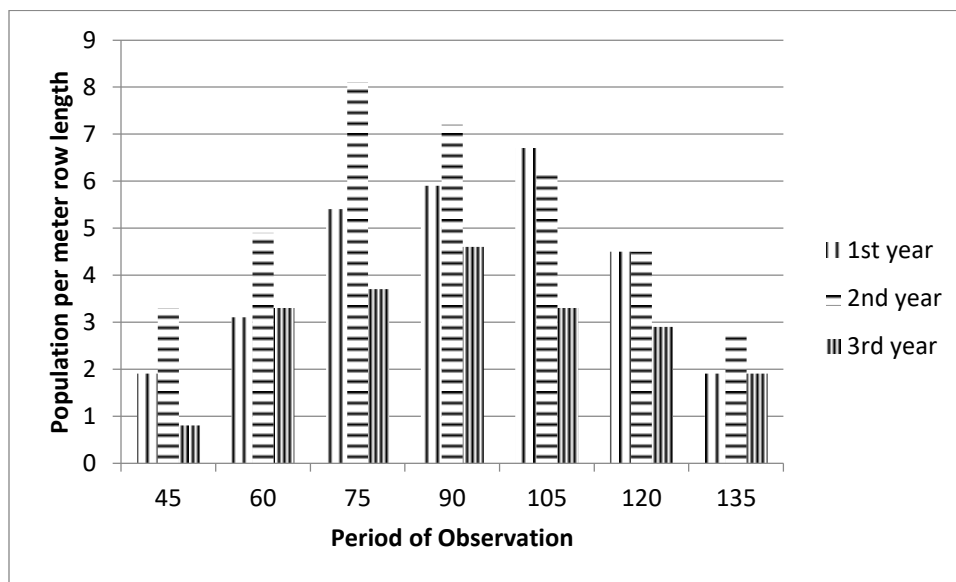


Figure 1: Temporal population distribution of tobacco caterpillar [*S. litura* (Fab.)] infesting groundnut crop.

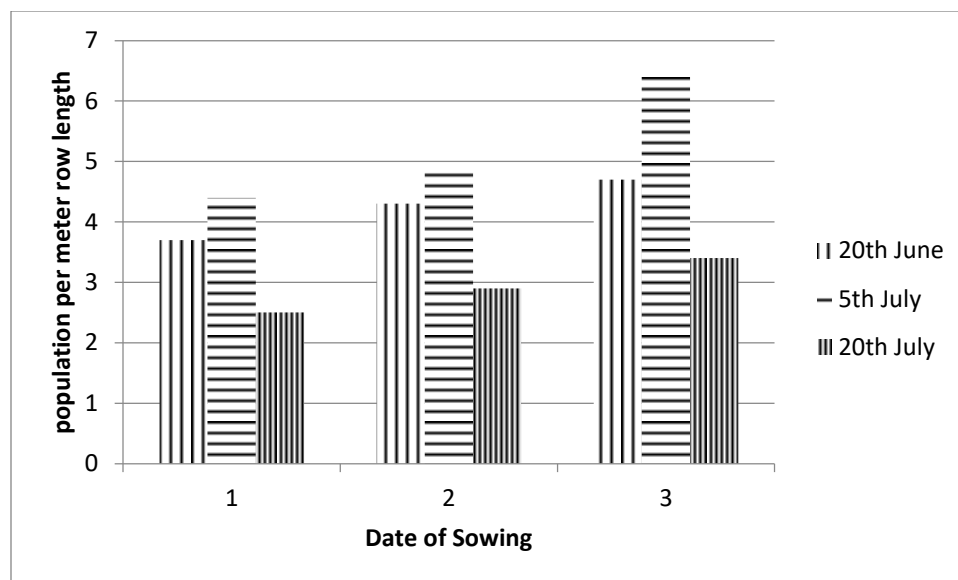


Figure 2: Population of tobacco caterpillar infesting groundnut crops sown on different dates.

The groundnut leaf damage (%) by tobacco caterpillar was maximum and minimum in groundnut crop sown on 20<sup>th</sup> July and 20<sup>th</sup> June respectively during all the three experimental years (Table 2). The interaction effect of sowing dates and periods of observation also showed significant effect on leaf damage (%) by tobacco caterpillar during all the three years of study. The average leaf damage (%) observed at fortnightly interval followed increasing trend starting from initial infestation i.e. 45 DAS until last observation at 135 days after sowing and the leaf damage (%) observed at different dates after sowing showed significant difference (Fig. 3).

Table 2: Effect of date of sowing on the groundnut leaf damage (%) by tobacco caterpillar [*Spodoptera litura* (Fab.)] (average of three years)

Date of Sowing	Leaf damage (%) DAS							Average
	45	60	75	90	105	120	135	
20 <sup>th</sup> June	5.4 (12.6)	8.8 (17.1)	11.5 (19.7)	15.8 (23.4)	18.6 (25.5)	20.9 (27.1)	26.7 (31.1)	15.4 (22.4)
5 <sup>th</sup> July	4.9 (11.1)	9.2 (17.7)	14.0 (21.9)	18.3 (25.4)	22.3 (28.1)	23.8 (29.0)	31.0 (33.8)	17.7 (23.8)
20 <sup>th</sup> July	5.1 (11.2)	8.9 (16.7)	15.0 (22.7)	20.6 (26.2)	25.7 (30.4)	28.5 (31.8)	36.9 (38.3)	18.7 (25.3)
Average	5.1 (11.6)	8.9 (17.2)	13.5 (21.4)	18.3 (24.9)	22.2 (27.9)	24.4 (29.3)	31.5 (34.4)	17.3 (23.8)
Difference between leaf damage observed in groundnut crops sown on different dates C. D. (P = 0.05) = 0.7								
Difference between leaf damage observed at different periods of observation						C. D. (P = 0.05) = 1.0		
Interaction between leaf damage observed in groundnut crops sown on different dates x periods of observation							C. D. (P = 0.05) = 1.7	

Figures in parentheses are Arc sine transformed values; DAS = Days after sowing.

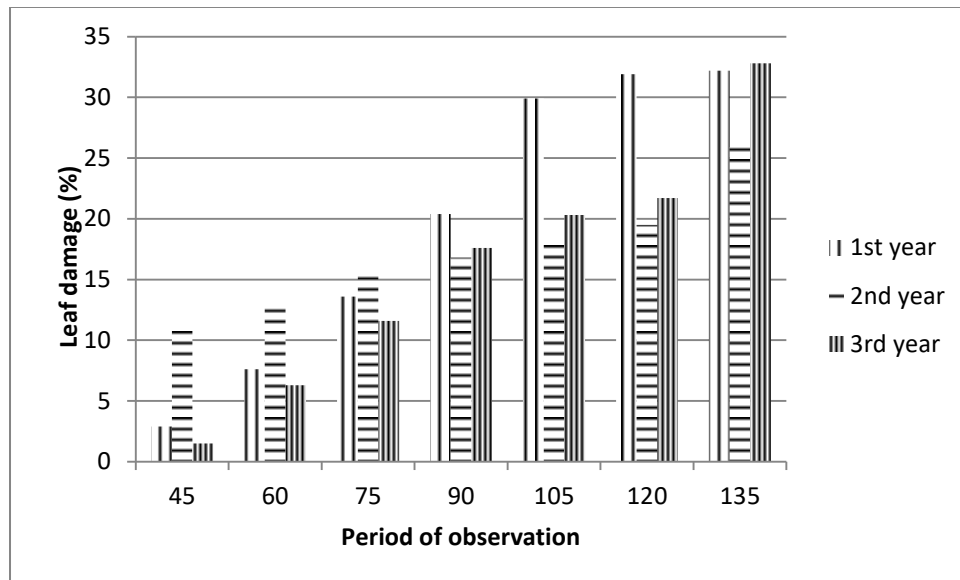


Figure 3: Temporal groundnut leaf damage by tobacco caterpillar [*Spodoptera litura* (Fab.)].

The average groundnut leaf damage (%) irrespective of years of study was maximum in 20<sup>th</sup> June sown crop followed by 5<sup>th</sup> July and 20<sup>th</sup> July sown crops. The overall leaf damage (%) was maximum during 3<sup>rd</sup> year followed by 2<sup>nd</sup> year and 1<sup>st</sup> year of experimentation (Fig. 4).

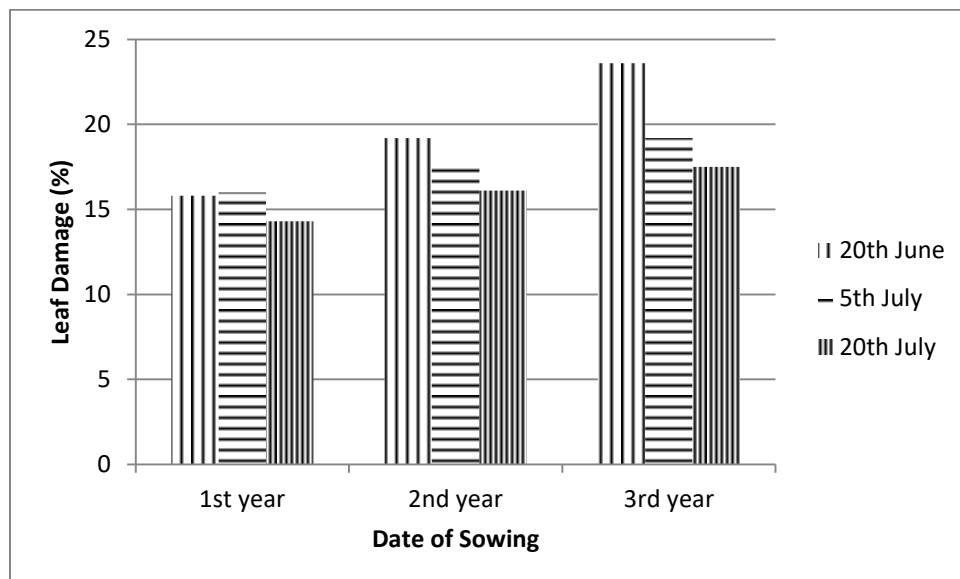


Figure 4: Leaf damage of tobacco caterpillar infesting groundnut crops sown on different dates.

The groundnut yield obtained from three different dates sown crops showed significant variation from each other (Table 3). The yield obtained from the groundnut crop sown on 20<sup>th</sup> June was found to be maximum while 20<sup>th</sup> July sown crop recorded minimum yield during 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> years, respectively (Table 3). The 5<sup>th</sup> July sown crop had intermediate pod yield. The yield of groundnut recorded during different years showed significant variation among themselves (Table 3). The maximum and minimum yields were recorded during 3<sup>rd</sup> and 2<sup>nd</sup> years, respectively. The

yield obtained during 1<sup>st</sup> year and the average of all the three years were found at par. The interaction effect of time of sowing and year on the groundnut yield was found to be significant.

Table 3: Effect of date of sowing and infestation of tobacco caterpillar on the yield (q/ha) of groundnut

Sowing Times	Yield (q/ha)			
	Years			
	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	Average
20 <sup>th</sup> June	22.3	21.7	23.6	22.5
5 <sup>th</sup> July	21.4	20.2	23.1	21.6
20 <sup>th</sup> July	20.1	19.3	21.9	20.4
Average	21.3	20.4	22.8	21.5
Difference between yield of groundnut sown on different dates				C. D. (P = 0.05) = 0.22
Difference between yield of groundnut sown on different dates during different years				C. D. (P = 0.05) = 0.22
Interaction between yield of groundnut crops sown on different dates x years				C. D. (P = 0.05) = 0.21

The results of the three years' study showed that for most favourable yield performance of groundnut 20<sup>th</sup> June is the best time of sowing followed by 5<sup>th</sup> July and 20<sup>th</sup> July. The late sown crop recorded higher tobacco caterpillar population and lesser groundnut leaf damage (%) while early sown crop produced higher yield than the crops sown on later dates. The higher population in 5<sup>th</sup> July sown groundnut crop could be due to early and prolonged infestation of tobacco caterpillar while 20<sup>th</sup> June sown crop though attracted tobacco caterpillars at the earliest but they were suppressed by early arrival and attack of natural enemies which mostly encountered were spiders (*Oxyopes* sp. and *Thomisus* sp.), dragonflies (*Acisoma panorpoides* and *Rhyothemis variegata* Fab.), rove beetle (*Paederus fuscipes* Curtis) and insect parasitoids (egg – larval parasitoid - *Chelonus* sp., larval parasitoid – *Apanteles* sp. and *Cotesia* sp.). The prevalence of natural enemies of tobacco caterpillar is also reported by several other workers from different cropping systems. Altogether, more than 100 species of natural enemies - parasitoids and predators have been reported from different parts of the world (Rao *et al.* 1993). The tobacco caterpillar is a preferred host of number of spiders (Sitaramaiah, *et al.* 1980). The findings of the present study are in conformity with the findings of various other workers who have reported that the monsoon based groundnut crop suffer from a number of insect pests including tobacco caterpillar (Reddy, 1988, Nath and Singh 1998b and Nath *et.al.*, 2010 and 2011). Das and Sontakke (1994) studied the effect of four sowing dates on the incidence of insect pests and yield of groundnut during rainy season and reported that crops sown during 3<sup>rd</sup> week of June to 1<sup>st</sup> week of July recorded higher yield and lower incidence of insect pests compared with crops sown during 3<sup>rd</sup> week of July to 1<sup>st</sup> week of August. Deka *et al.* (1997) reported that dates of sowing of winter groundnut showed spectacular effect on growth and yield attributes of groundnut varieties. Raju *et al.* (1988) found that the incidence of insect was higher on the crop sown on 1<sup>st</sup> May than the crop sown on 1<sup>st</sup> June. These reports are in conformity with the present findings and also signifies the contribution of abiotic and biotic factors on the temporal population dynamics of tobacco caterpillar and its natural enemies. The late sown groundnut crops were relatively more succulent due to frequent rains and so high relative humidity (>70%) during July and August months in Varanasi region of India and therefore more attractive for tobacco caterpillar. Though the early sown groundnut crop recorded higher percentage of leaf damage than the late sown crops but the long duration presence of the crop in the field helped the plant to recover the leaf damage and so yield by producing additional leaves and flowers. The

groundnut sown on later dates have lesser time to compensate the foliage damage and therefore relatively more yield loss. Consequently, on the basis of three years study it is found that 20<sup>th</sup> June is the most appropriate sowing time for groundnut in Varanasi region followed by 5<sup>th</sup> July in managing the tobacco caterpillar population. Kathryn et al (2014) had reported similar results and concluded on the basis of their field experiment that early planting of chilli (January 15<sup>th</sup> or January 30<sup>th</sup>) resulted in low incidence of aphids, thrips, jassids, whitefly and fruit borer except mites. Such low level of insect pest caused less crop injury which resulted in enhancing green pod yield of chilli.

#### 4. Conclusion

In the light of pooled data regarding tobacco caterpillar infesting groundnut as affected by sowing dates as a pest control measure, it is concluded that early sowing (June 20<sup>th</sup> or July 5<sup>th</sup>) resulted in low incidence of tobacco caterpillar. Such low level of insect pest caused less groundnut leaf injury which resulted in enhancing the foliage and yield of groundnut. So, it is suggested that for early sowing at Varanasi region of Uttar Pradesh the appropriate sowing time can be June 20<sup>th</sup> and/or July 5<sup>th</sup>.

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