EFFECT OF THINNING TIME AND VARIETY ON YIELD PERFORMANCE OF SESAME

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CERTIFICATE

This is to certify that thesis entitled, " ***Effect of thinning time and variety on yield performance of sesame****" submitted to the, Department of Agronomy, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* ***MASTER OF SCIENCE IN AGRONOMY,*** *embodies the result of a piece of bona fide research work carried out by* ***Tahmina Sultana****, Registration No.:* ***11-04347*** *under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

I further certify that such help or source of information, as has been availed of during the course of this investigation has been duly been acknowledged.

Dated:
Place: Dhaka, Bangladesh

Prof. Dr. H. M. M. Tariq Hossain
Supervisor
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Dedicated

To

My Beloved Parents

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ABSTRACT

An experiment was conducted at the Sher-e-Bangla Agricultural University Farm, Dhaka 1207, during Kharif-1 (March – June), 2017 to study the yield performance of sesame varieties in response to thinning times and varieties. The experiment was composed of two factors like variety and thinning time. The varieties were BARI TIL 2 and a local variety designated V_1 and V_2 respectively. There were six levels of thinning times practiced at 15 days after sowing (DAS), at 20 DAS , at 25 DAS , at 30 DAS , at 35 DAS and at 40 DAS designated at T_1, T_2, T_3, T_4, T_5 and T_6 respectively. The experiment was laid out by Split Plot Design with 3 replications. Significant effects of treatments were observed on height (cm), dry matter plant^{-1} (g), number of branches plant^{-1}, , number of capsules of different branches, number of capsules plant^{-1}, 1000 - seed weight (g), seed yield (kg ha^{-1}), stover yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvest index (%). Significantly highest yield was obtained from V_2 (local Variety) due to highest no. of capsules plant^{-1} (47), 1000 - seed weight (2.68 g), seed yield (590 kg ha^{-1}) and harvest index (21%). Moreover , thinning at 25 DAS appeared with the highest seed yield (656 kg ha^{-1}), capsule plant^{-1} (56) and 1000 - seed weight (2.933). Results revealed that the highest number of capsules plant^{-1} (64.67), 1000 seed weight (2.998 g), seed yield (761.80 kg ha^{-1}), stover yield (2693 kg ha^{-1}) and harvest index (22.3%) were obtained by the combined effect of V_2T_3 **(**Local variety thinned at 25 DAS **)**. Contrary to that the lowest number of capsule plant^{-1} (25.97) and seed yield (387.10 kg ha^{-1}) were obtained from the combined effect of V_1T_4 **(**BARI TIL 2 thinned at 30 DAS) treated plots.

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BARI	=	Bangladesh Agricultural Research Institute
cm	=	Centimeter
^{0}C	=	Degree Celsius
CV	=	Co-efficient of variation
DAS	=	Days after sowing
et al.	=	and others
Kg	=	Kilogram
Kg/ha	=	Kilogram/hectare
g	=	gram
LSD	=	Least Significant Difference
MoP	=	Muriate of Potash
m	=	Meter
TSP	=	Triple Super Phosphate
t/ha	=	ton/hectare
%	=	Percentage

CHAPTER I

INTRODUCTION

Sesame (*Sesamum* indicum) is the most ancient crop ranking the 4th position among the oilseed in the world production. It belongs to Pedaliaceae family and has bell shaped flower with opposite leaves on branches. Sesame is cultivated for centuries as an important oilseed crop particularly in the developing countries of Asia and Africa for edible oil (Weiss, 2000). The agro-ecological zone favourable for sesame production is between latitude 6^0 and 10^0 N (Agboola, 1979). The highest production comes from Asia (FAOSTAT, 2000) . The oil content of sesame seed is 42-54% as well as protein is 22-25% (Anon, 2001) . Natural antioxidents such as Sesamol and Sesaminol are also present in sesame oil (Olowe and Basuri, 2003). Phytosterol properties also found in sesame oil which prevent cholesterol production (Watt and Brayer 1962). Sesame is fairly high valued crop which has so many uses as in bakery, salad, fast food, paint, cosmetics, soap, perfumes and insecticides. In Bangladesh , sesame is the second largest source of edible oil contributing 11.03% of the total oilseed production (Hossain and Salahuddin, 1994). Sesame occupying 4.22% of the total cropped area in Bangladesh which is very important next to cereal crops (BBS, 2009). Bangladesh produces 29,965 m tons of sesame from about 33,275 hectare of land under cultivation (BBS, 2012). But this production is not sufficient to cover the demand of edible oil of the country. So, the country has to import a huge quantity of edible oil in the expense of precious foreign exchange.

The average sesame yield per hectare is reported very low in most of the producing countries between 300-350 kg (Philip, 1977). In Bangladesh, low yield of sesame is due to inadequate management practices with lack of desired plant population per unit area (Zaman, 1986). This lower yield discourages the grower which is the important reason for declining the area under sesame cultivation. Varietal differences and planting geometry also show significant effect on yield of sesame leading to a decline in the total area devoted to its cultivation (Jakusbo et al. 2013).

Thinning after sowing is an important operation for the maintenance of crop to maximize the yield. Competetion among plant decreases through thinning. Increase in plant density may decrease the dry matter production (Balasubramanian and Palaniappa, 2007). Planting density has considerable effect on vegetative growth as well as yield of sesame plant (Rowden *et al*., 1981).Densely grown sesame plants produce less branches and bear less flowers, which

induces considerable reduction in yield. As such, best thinning time may indicate the maximum branch induction in sesame plant which may contain more number of capsules. Population density maintaining through thinning determines the canopy structure which affect the crop in two different ways such as light interception and their subsequent physiological development (Evans *et al.* 2013). Thinning make the way to give some place between two plants (Jakusko *et al.* , 2013) Spacings of plant to plant varies in different species to control over-crowding which may affect growth and development of yield of cultivated species (Sajo *et al*, 2002). The space available for individual plant growing in a community affects the yield and quality of produce (Nadeem *et al.* , 2005). The establishment of an adequate and uniform crop stand is critical to achive high seed yield (Wysocki and Sirovatka, 2010).Moreover, sesame cultivars are variable in their response of plant density. The seed yield of sesame is significantly influenced by cultivars (Hazarika, 1998). Considering the above mentioned reasons, it is necessary to identify the appropriate variety with appropriate thinning time for the yield improvement of sesame cultivation in Bangladesh.

Objectives:

I. To determine the effect of thinning time on yield performance of sesame
II. To determine the effect of variety on yield performance of sesame
III. To evaluate the combined effect of thinning time and variety on yield and yield performance of sesame

CHAPTER II

REVIEW OF LITERATURE

2.1 Effect of thinning time :

To study the yield performance of sesame in response to population density and source-sink manipulation, Two factors (A) population density and (B) source-sink manipulation were initiated During Kharif-1 (March – June), 2008 . Three population densities viz. (1) 30 plants m^{-2} (D_1), (2) 40 plants m^{-2} (D_2) and (3) 50 plants m^{-2} (D_3) and four source-sink manipulation viz. (1) no removal (M_0), (2) removal of lower empty leaves, lower empty branches and top of the inflorescence (M_1), (3) removal of all branches (M_2) and (4) removal of lower empty leaves and lower empty branches (M_3) were comprised for the experiment. Population density, source-sink manipulation and their combination effect was observed on the basis of plant height (cm), number of branches $plant^{-1}$, leaf area index, dry weight $plant^{-1}$, dry weight m^{-2} (g), crop growth rate, number of capsules $plant^{-1}$, number of capsules m^{-2}, number of seeds $capsule^{-1}$, 1000 seed weight (g), yield $plant^{-1}$ (g), total yield (kg ha^{-1}), stover yield (kg ha^{-1}) and harvest index. The highest number of capsules $plant^{-1}$ (28.38), number of capsules m^{-2} (1135.20), number of seeds $capsule^{-1}$ (70.66), 1000 seed weight (3.45 g), total yield (1725.45 kg ha^{-1}) and harvest index (40.72) were obtained with the combined effect of D_2M_1 **(**40 plants m^{-2} + removal of lower empty leaves, lower empty branches and top of the inflorescence**)**. But the lowest number of seeds $capsule^{-1}$ (66.30) and total yield (1060.75 kg ha^{-1}) were obtained with the combined effect of D_3M_2 **(**50 plants m^{-2} + removal of all branches**)**. (Alim, 2009).

A field experiment was conducted to evaluate the effect of row spacing on the yield and yield contributing characters of sesame during Kharif season, using the varieties (V_1 = T_6, V_2 = Batiaghata local Til and V_3 = BINA Til) and the row spacings (S_1 = 15 cm, S_2 = 30 cm and S_3 = 45 cm). Varieties and row spacings significantly influenced the Yield. The variety BINA Til give the highest seed yield while the lowest was by the variety Batiaghata local Til and the highest seed yield was produced by row spacing 30 cm while the lowest was by row spacing 45 cm (Nandita *et al.*, 2009).

Tahir *et al*., (2012), conducted a field trial to evaluate the impact of sowing date and row spacing on the yield and quality of sesame variety TH-6. Sowing dates (15th June, 25th June, 05th July and 15th July) were placed in main plots and row spacing (15, 30 and 45 cm) were assigned to the sub-plots. The experiment was arranged in randomized complete block design (RCBD). The results revealed that all the yield attributing parameters were significantly affected by different sowing dates with different row spacing. The maximum plant height (158.9 cm), number of plants per m2 yield (0.857 Mg ha–1), harvest index (21.42%), and oil yield (0.371 Mg ha–1) were recorded in plots where sesame was sown at 15th June with row spacing of 15 cm. TH-6 variety of sesame sown on 15th June with 15cm row spacing seems to be best to get higher yield under agro-climatic conditions of Faisalabad, Pakistan.

This study was carried out to determine the effects of different inter- and intra-row spacings on the yield of sesame; the experiment was performed in Antalya West Mediterranean Agricultural Research Institute in 2009. The experiment follow split plot design and row spacing (30, 40, 50, 60 and 70 cm) were assigned to the main plots and and intra-row spacing (5, 10, 20 and 30 cm) were assigned to the subplots. Seed yield, oil ratio, oil yield, protein ratio and protein yield were observed.. Wider inter row spacing and intra-row spacing, resulted in decreased seed yield, oil yield and protein yield theoriticaly. The highest seed yield, oil yield and protein yield (respectively, 1115.0 kg ha-1, 551.3 kg ha-1, 224.7 kg ha-1) were obtained from 30x5 cm plant density while the lowest seed yield, oil yield and protein yield (respectively, 677.0 kg ha-1, 327.0 kg ha-1, 130.0 kg ha-1) were recorded from 70x30 cm plant density. As a result, 30 cm row spacing, and 5 cm intra row spacing are the most suitable plant densities. (Ozturk, O. and Şaman O., 2012) .

Fischer and Laing (1976), carried out an experiment describing the effects of crop thinning on grain yield and its components of wheat variety *(Triticum aestivum*) for over 5 years in northwest Mexico. It was found that thinning reduce the competition for light, thus increasing photosynthesis in the plants remaining after thinning. There were significant responses in seed yield with thinning between about 50 and 100 days after sowing, and in number of spikes and of seeds with thinning between 50 and 90 days (50 % anthesis was occured at 87 days). Number of spikelet per spike showed less response to early thinning (before 50 days). Number of seeds/spikelet and kernel weight showed positive responses to thinning between

65 and 90 days, and 90 and 115 days, respectively. Anthesis thinning was carried out on 21 separate crops: the kernel weight increase relative to the unthinned control ranged from 6 to 41%. Anthesis thinning led to increases in stem weight during the first half of the grain filling period, followed by increases in seed growth rate in the latter half. With higher temperature and lower radiation there is increase in final kernel weight during grain filling; these variables explained 64 % of the variation in kernel weight response. It was revealed that anthesis thinning is an awesome useful technique for improving yield.

Effects of nitrogen and intra row spacing on the growth and yield of sesame was evaluated in rainy seasons in 2010 by Haruna . Three levels of nitrogen in the form of urea (0, 50, and 100 kg N per ha) , three intra row spacing (7.5, 15 and 22.5cm) were used as treatments. combinations and the treatments with three replications were laid out in a randomized complete block design . Plant height, leaf area index, number of branches per plant, total dry matter per plant and days to 50% flowering were optimized at 100 kg N ha-1 and 22.5cm intra row spacing. At 50 kg ha-1 of nitrogen Numbers of capsules per plant, capsule weight per plant, grain yield per plant and grain yield per hectare were optimized. Maximum number capsules per plant, capsule weight per plant, grain yield per plant were recorded at 22.5cm intra row spacing while, maximum grain yield per hectare was recorded at 15cm intra row spacing. Application of 50 kg N ha-1 and planting at 15cm intra row spacing is therefore recommended for higher sesame yield in this area. However, the highest grain yield per hectare was not recorded at 30cm spacing but at 15cm intra row spacing probably because of the higher plant population at 15cm spacing.

Varying patterns for growing different varieties of branched or non-branched sesame are available. Rows of sesame adopted at varying spaces of 37.5, 50 and 60 cm while the plants were arranged horizontally at 5,10,15 and 20 cm and the density of the plot was surveyed over an area ranging from 83000 to 530,000 plant/ha was under experiment. Results showed that an increase in row-spacing from 37.5 to 60 cm significantly atttributed on the yield component after combined analysis of two years, . The stem diameter also increase from 16.3 to 19.4 mm, the pod number from 59 to 84 per plant, as well as the weight per thousand seeds from 3 to 3.3 grams. Moreover, an increase in plant spacing from 5 to 20 cm caused a decrease in stem height from 180.2 to 169.7 cm, an increase in stem diameter form 15.8 to 19.8 mm, a rise in pod number from 44.6 to 96.5 and in the seed content from 59.3 to 74.4 per pod. The relevance of the seed yield and row spacing obeyed a falling linear regession

curve, while the seed yield and plant thinning times showed a non-linear behaviour and estimated a maximum yield at 10 cm distance. Finally, the planting density reflected a non-linear fourth power equation. The maxinum seed and oil yield was then estimated at a density of 200,000–250,000 plant per hectare. In view of higher yield at the 37.5 cm row treatment and the 10 cm plant treatment, together with regressive equations, the above pattern (37.510cm) shall be recommended for unibranched sesame growing in Khuze. (Rahnama and Bakhshandeh, 2006).

A field study to evaluate the "growth and yield of sesame (*Sesamum indicum* L.) under the influence of planting geometry and irrigation regimes" was carried during Kharif , 2013. The experiment was laid out in a three replicated randomized complete block design (RCBD) factorial, having net plot size 3 × 3 m (9 m2). The treatments comprised three planting geometry (30 × 20 cm, 45 × 15 cm and 60 × 10 cm) and three irrigation regimes (2 irrigations at 20 and 40 DAS, 3 irrigations at 20, 40 and 60 DAS and 4 irrigations at 20, 40, 60 and 80 DAS). The analysis of variance showed that all the planting geometry and irrigation regimes significantly ($P < 0.05$) affected growth and yield of sesame. Planting geometry of 45 × 15 cm resulted in maximum branches plant−1 (15.67), capsules plant−1 (38.00), seeds capsule−1 (51.44), seed weight plant−1 (31.89 g), seed index (2.83 g), biological yield (2301.23 kg·ha−1), seed yield (742.33 kg·ha−1) and harvest index (30.44%), followed by planting geometry of 60 × 10 cm in all the parameters. However, minimum growth and yield traits of sesame were recorded under planting geometry of 30 × 20 cm. Moreover, plant height was maximum (99.89 cm) under planting geometry of 30 × 20 cm. Among irrigation regimes, four irrigations (20, 40, 60 and 80 DAS) recorded maximum plant height (103.33 cm), branches plant−1 (16.44), capsules plant−1 (41.22), seeds capsule−1 (54.56), seed weight plant−1 (33.22 g), seed index (2.92 g), biological yield (2321.21 kg·ha−1), seed yield (748.78 kg·ha−1) and harvest index (31.00%), followed by three irrigations (20, 40 and 60 DAS) almost in all the traits. However, minimum growth and yield traits of sesame were recorded when crop was applied two irrigations (20 and 40 DAS). In case of interactive effects, the interaction of planting geometry of 45 × 15 cm × four irrigations (20, 40, 60 and 80 DAS) resulted in maximum attributes. (Nadeem *et al.* , 2015)

Sesame is grown predominantly in *Kharif* with low productivity. To Minimizing environmental effects the better management option is to grow it in summer.An experiment was conducted with three sowing dates (D1=1st February, D2=15th February and D3=1st

March) and three row spacing (S1= Broadcasting, S2= 30x 10 cm and S3= 45x10 cm) to decide appropriate date of sowing and row spacing. Consistent results were obtained over the 3 years. Reduction in vegetative duration (VD) and reproductive duration (RD) was observed due to delay sowing. Date of sowing also affected the growing degree days (GDD) during VD and RD. Decreased GDD for RD with delay sowing was related to reduction in length of RD. Early or late sowing than 15th February adversely affected the seed yield. Average yield advantage of 15th February sown crop was 151.7% and 10.1% higher over early and late sown crop, respectively. Yield attributing traits also showed maximum expression in 15th February sown crop. Spacing treatments differ significantly for seed yield. The highest seed yield was recorded at 30x10cm spacing to the tune of 13.6% and 15.4% higher over broadcasting and 45x10 cm spacing, respectively. Sowing of sesame on 15th February at spacing of 30x10cm is recommended for sustainable cultivation in semi-arid environments with high economic benefit. (Bachubhai and Devshibhai, 2016.).

Sesame or Beniseed (*Sesamum indicum L.)* is cultivated in almost all the tropical and subtropical countries of Asia and Africa. However, low yield is obtained as results of poor cultural practices among others discourage growers. Field experiments were carried out to investigate the effects of row spacing on the growth and yield of Sesame (*Sesamum indicum L.*). The result revealed that there were significant effect of spacing on the number of seed per capsule, capsule per plant and length of capsule as well as 1000 seed weight and yield per hectare in both seasons. From the findings of this study, it is suggested that 75 x 10cm spacing should be adopted in Yola. (Jakusko *et al.* , 2013).

Field trials were conducted during 2006 and 2007 rainy seasons at the University of Maiduguri Teaching and Research Farm, Maiduguri, Nigeria, to determine the influence of inter-row spacing and plant density on growth, development and yield of sesame. The treatments were three inter-row spacing (25, 50 and 75 cm) and four plant densities (2, 4, 6 and 8 plants/stand). A split plot design was followed where inter-row spacings assigned to the main plot and plant density were assigned to the sub plot and replicated three times. Results revealed that plant height significantly decreased with increase in inter-row spacing. The tallest plants were recorded for 25 cm at 3 and 6 WAS, but values declined significantly at closer inter rows as the growth period progressed. Dry stalk weight increased significantly with increase in spacing and plant density. Seed yield was significantly higher at 50 cm than 25 cm or 75 cm spacing in 2006 and slightly higher in 2007. The 75 cm spacing recorded

significantly higher seed yield than 25 cm or 50 cm spacing for the combined mean. Seed yield was also significantly higher for 6 plants / stand than the other plant densities in 2006. In 2007, 4 plants / stand significantly realized higher seed yield than the other treatments. There were significant interactions on plant height, number of days to 50% flowering, seed yield and seed weight. The interactions showed that seed yield was significantly higher at 25 cm with 6 plants per stand in 2006 and at 25 cm with 4 plants per stand in 2007. The linear relationships showed that seed yield was negatively correlated with plant height at 3 WAS (r = - 0.87***), days to 50% flowering (r = - 0.67***), dry stalk weight (r = - 0.40***) and seed weight (r = - 0.71***). Seed weight was positively correlated with days to 50% flowering and dry stalk weight (r = 0.40*** to 0.68***). Grain yield of sesame could therefore be enhanced by sowing at 50 cm x 25 cm spacing with 4-6 plants per stand (320,000 – 480,000 plants/ha) to reduce plant competition in Nigeria's Sudan savanna. (Adam *et al*. ,2013)

The effect of row spacing (RS) and irrigation (IR) on total protein, total oil, and fatty acid composition of Harran-grown sesame seed was studied. Total oil content of sesame varied from 46.4 to 51.5%. The oil and protein contents were significantly different among treatments ($P < 0.01$) in 1998 and 1999. IR affected oil content significantly ($P < 0.01$) in both years, and RS had no significant effect. The protein content was significantly influenced by RS and IR at $P < 0.05$ and $P < 0.01$, respectively. RS 70 cm had the highest protein content followed by RS 60, 50, and 40 cm, respectively. IR every 24th day resulted in the highest level of protein, followed by 18th-, 12th-, and 6th-day irrigation, respectively. Correlation coefficients between protein and oil content were –0.34 in 1998 and –0.59 in 1999. RS ($P < 0.05$) and IR ($P < 0.01$) influenced oleic and linoleic acid contents significantly. Interactions of RS and IR were also found to be significant ($P < 0.05$) over the oleic and linoleic acid levels. (Alpaslan *et al*. , 2001)

2.2 Effect of variety:

An experiment was carried out to evaluate morphology of sesame from different origins. Seventeen sesame varieties originating from El Salvador, Tanzania, Kenya, India, Cambodia and Vietnam were studied. The field experiment was done in the Mekong Delta region, Vietnam. Fifteen agronomic traits were analysed to select the best varieties for use as potential breeding source. Sesame Varieties collected from Africa and Central America influenced by the climatic differences between Vietnam and from their place of origin. Large biomass growth, late onset of flowering and low yield was the most pronounced features. Sesame varieties from Vietnam and Cambodia gave high seed yields and developed well in the Mekong delta region. Based on the average, the order of the varieties from low to high in seed yield ranked as follows Tanzanian sesame < El Salvadoran sesame < Kenyan sesame < Indian sesame < Vietnamese sesame < Cambodian sesame. Several varieties of Cambodian and Vietnamese were identified as high yielding and potential sources to be included in future breeding activities. This results could be used for improvement of sesame varieties in various regions (Pham et al. , 2010)

An experiment was conducted at the research field by *Akter et al*. to evaluate growth and yield performance of sesame genotypes. Five sesame genotypes i.e. DB-6992, BD-6995, BD-7001, BD-7011 and Hathazari-4 were used in the experiment . The genotypes significantly differ in photosynthetic rate, dry matter partitioning and seed yield. The earliest genotype was Hathazari-4 and the latest was BD-7011. In genotype Hathazari-4 the highest stem dry weight, leaf dry weight, capsule dry weight, leaf area index, light interception, photosynthetic rate were recorded. The number of capsules plant-1 and the number of seeds capsule-1 were also highest in the genotype Hathazari-4, while the lowest was being recorded in the genotype BD- 7001. Weight of 1000-seed was the maximum in genotype BD-6992 and the minimum in the genotype BD- 7011. The highest seed yield (3.52 tha-1) was recorded in the genotype Hathazari-4 and the lowest in the genotypes BD-6992 followed by BD-7001. The highest oil content (41.39%) was recorded in the genotype BD-6992 and the lowest (39.72%) in the genotype Hathazari-4 but the highest oil yield (1.53 t ha-1) was recorded in the genotype Hathazari-4. It may be concluded that the sesame genotype Hathazari-4 may be cultivated for higher seed yield and oil production.

For ascertain the component (s) maximizing yield, 21 genotypes (parental cultivar and 20 macromutants) of sesame (Sesamum indicum. L., var - B-67, Family: Pedaliaceae) were

analyzed based on genetic parameters such as genetic variability, character association and path analysis considering seven yield related traits (plant height, number of primary branches/plant, total branches/plant, distance from base to first branching, capsules on main axis, total capsules/plant and capsule length) and yield (seed yield/seed protein content/seed fatty oil content) in rainfed kharif season of West Bengal plains. Total capsule per plant is predicted to be the most important selection criterion. For assessment of variation in yield attributes, 6 desirable plant types (parental cultivar and five mutants) were given multilocational trial under four different agroclimatic area and the results obtained are discussed and the better plant types are predicted. (Chowdhury *et al*. , 2010)

A field experiment was conducted to assess the impact of three population densities and two seasons on seed yield of 14 genetically diverse Nigerian sesame genotypes. Cultivars 530-6-1, Type A and Pb til No 1 generally outperformed others. Population density of 166,667 plants ha-1 gave 40% more yield than that at 266,667 plants ha-1 and was the best for maximizing yield under rain-fed conditions. Regarding seasonal influences, yield was about 11% higher in the 2002 season than in 2001. Heritability results revealed that seed weight is highly heritable in sesame with a possibility for high selection gains, while the other yield components were greatly influenced by population densities and seasons signifying moderate-to-high gains. Significant positive relationship was found between seed yield and capsule weight, capsule number and seed production efficiency implying
that yield is a function of these parameters and selection based on these could further improve the yield potential.(Adebisi *et al*. , 2005)

A two-year study was carried out by Ogbonna and Ukan (2012) to evaluate the seed yield potentials of thirteen sesame accessions in the derived savanna agro-ecology of Southeastern Nigeria. It was aimed at selecting high yielding accessions for cultivation in this zone. This is a part of a research programme mounted to arouse farmer's interest in the cultivation of sesame in the derived savanna zone of Nigeria. The accessions are Adaukiari, Chimkwale yellow, 34-4-1, Cameroun white, Parchequeno, E8, Aliade, Kachia, Jigawa, Chimkwale, 69-1-9, Yobe gadaka and NCRI BEN 02M. The experiment was laid out in a randomized complete block design (RCBD) in three replications. The result revealed that significant variation among the accessions in seed yield parameters. It also showed that some of the accessions produced outstanding seed yield as comparable to yields obtained in the sesame

producing areas in Nigeria. Accessions 34-4-1, Cameroon white and Chimkwale which showed high seed yields of 863.9, 775.6 and 640.3 kg/ha, respectively, were recommended to farmers in the zone.

Sesame is almost entirely cultivated under rain-fed in the Sudan. There is increasing evidence that the uses of poor management practices (especially the practice of low seed rate) as well as traditional cultivars are the main yield lim-iting factors in sesame farms of sandy dunes in north kordofan of Sudan. Field experiment was conducted to determine the effects of four different seed rates on the growth, yield and yield components of three sesame varieties. Three varieties of sesame (Sesamum indicum L), Elobeid1, Promo (recently improved cultivars) and Hirhri (an old traditional cultivar) were used. The plants were sown at four seed rate: 0.5, 1.0, 1.5 and 2.0 kg ha-1. The results indicated that increasing seed rate significantly decreased the number of capsules per plant and seed yield per plant. Seed rates of 1.5 and 2.0 kg ha-1 were optimum to maximizing seed yield per unit area. The three cultivars had relative similarities in final seed yield (ton ha-1).(Naim *et al.* , 2012)

To study the effect of dates of sowing and improved cultivars on growth and yield of summer sesame in North Bengal five different dates of sowing (10th February, 20th February, 2nd March, 12th March and 22nd March and three cultivars of sesame (Rama, Savitri and Tillotama) with three replications. The highest (114.66 and 115.83 cm) plant height was recorded when sesame sown on 12th March (D4) and which was statistically at par with 2nd March (D3). Among the varying date of sowing, the highest dry matter accumulation, leaf area index and crop growth rate was recorded in 2nd day of March compared to the other date of sowing. Among the improved cultivars of sesame, the variety Rama recorded higher plant height, dry matter accumulation, leaf area index and crop growth rate compared to Savitri and Tillotoma. The highest yield was recorded when sesame sown on 2nd March which was 55.99 and 40.85% higher than the crops sown on 22nd March during 2013 and 2014 respectively. Rama also exhibited highest seed yield recording 17.70 and 12.06% higher than the cultivars Tillotama and Savitri. The date of sowing significantly influenced the yield attributes and highest yield attributes was recorded when sesame sown on 2nd March. Improved cultivar, Rama recorded the highest yield attributing characters compared to the Savitri and Tillotoma. It can be concluded that sowing of sesame within 2nd March to 12th March is the optimum sowing dates of sesame to have optimum seed yield if grown as late summer crop. Result indicated that cultivar Rama can be adopted in *terai* zone

of West Bengal during summer season, because of its highest seed yield ability. (chongdar *et al.* , 2015)

The relevance of the vegetative and the pod characteristics to the taxonomy of three Nigerian species of sesame was investigated. The plant materials used are *Sesame alatum*, *Sesame radiatum* and *Sesame indicum.* After growing the plants for two years in the same environment, the seeds of each species were harvested and broadcast in a separate perforated 5 L plastic bucket filled with sandy loam soil. The buckets were kept at the nursery and watering carried out until seedlings were fully established. Two seedlings of each species were then transplanted to a 5 L plastic bucket filled with sandy loam soil and each bucket was replicated 20 times. The experimental design used was the completely randomized design (CRD). Each plant stand was thinned to one seedling two weeks after transplanting. Ten vegetative and five pod characteristics were investigated at flowering and harvest respectively. Mean values for each species were calculated and recorded from five plants randomly selected. Data were subjected to analysis of variance (ANOVA) and means separated using the least significant difference (LSD). Results revealed that the majority of the vegetative, pod and quantitative characteristics investigated show significant differences among the three species. These characteristics were used to construct a taxonomic key that facilitates the identification of the three sesame species. (Alege *et al.* , 2011).

CHAPTER III
MATERIALS AND METHODS

In this chapter, the details of different materials used and methodology followed during the experimental period are described.

3.1 Experiment site and soil

The experiment was conducted at the Sher-e-Bangla Agricultural University (SAU), Dhaka, Bangladesh during Kharif-1 (March – June), with objectives as mentioned. The experimental field is located at 23^0 41' N latitude and 90^o 22' E longitude at a height of 8.6m above the mean sea level. It belongs to the AEZ 28, Madhupur Tract (FAO, 1988). It was Deep Red Brown Terrace Soil which was sandy loam in texture having pH ranged from 5.47 to 5.63, a member of hyperthermic Aeric Haplaquept under the order Inceptisol having only few horizons, developed under aquic moisture regime and variable temperature conditions. General characteristics of the soil are presented in Appendix I.

3.2 Climate

The experimental field was situated under the sub-tropical climate; usually the rainfall is adequate during kharif season, (April to September) and a few in Rabi season (October to March). In Rabi season temperature is generally low and there is plenty of sunshine. The temperature tends to increase from February as the season proceeds towards Kharif.

3.3 Crop

Two sesame (*Sesamum indicum* L.) varieties were used in the experiment. The first one was BARI TIL 2, developed by Banglsdesh Agricultural Research Institute and the another one was local variety collected from Manikgonj. It is a broadleaved plant that grows about 5 to 6 feet tall, with height depending on the variety and growing conditions. Large, white, bell-shaped flowers, each about one inch long, appear from leaf axils on the lower stem, then gradually appear up the stem over a period of weeks as the stem keeps elongating. One to three capsules of seeds will develop at each leaf axil. Seed capsules are 1 to 1.5 inches long, with 8 rows of seeds in each capsule.

3.4 Treatments

The Experimental treatments consisted of two factors i.e. variety and thinning time which were indicated as follows:

Factor: a)Variety : BARI TIL 2 and Local variety designated as V_1 and V_2 respectively

Factor : b) Thinning time : The levels of thinning times- 15 days after sowing (DAS), 20 DAS, 25 DAS, 30 DAS, 35 DAS, 40DAS designated as T_1, T_2, T_3, T_4, T_5 and T_6 respectively.

3.5 Experimental design

The experiment was laid out in Split Plot Design assigning variety in the main plot and thinning time in the sub-plot. The size of unit plot was 3 m x 1.5 m. The total number of treatment combinations was (6 Levels of thinning time × 2 levels of Variety) 12 and the number of unit plots were 36, as there were 3 replications for each treatment factor.

3.6 Germination Test

Before sowing seeds, germination tests were done in the laboratory and germination percentage was found counted over 92% which was calculated using the following formula -

Percentage of germination $= \frac{Number\ of\ germinated\ seed}{Number\ of\ seed\ set\ for\ germination} \times 100$

3.7 Land preparation

The land was opened with the tractor drawn disc plough on 27 march, 2017. Ploughed soil was then brought into fine tilth. The stubble and weeds were removed. Experimental lands were divided into unit plots following the design of the experiment.

3.8 Fertilizer application

Cow dung was applied at the rate of 10 t/ha during the final land preparation. Sixty kg N/ha were applied at two installments in the form of Urea. Other fertilizers were applied at the rate of 30kg/ha of P_2O_5, 25kg/ha of K_2O, 5kg/ha of S, 0.34kg/ha of B and 1.8 kg/ha of Zn according to recommendation dose cited in Krishi Projukti hatboi. All fertilizers were incorporated into the soil as broadcast before sowing of seeds. Rest amount of urea was top dressed during flower initiation of sesame.

3.9 Sowing

Seeds were sown @ 8 kg ha^{-1} in 29 March, 2017 in lines by maintaining 30 cm apart. Seeds were placed around two cm depth and then rows were covered with loose soil properly.

3.10 Cultural practices

The desired population was maintained by thinning out of plants by keeping 5 cm (approximately) plant to plant distance. Again, Irrigation, mulching, weeding and plant protection measures etc. were performed to obtain better crop establishment and proper plant growth.

3.11 Harvesting

At maturity, the crop was harvested from of 1 m^2 area selected at random place of central part of each plot. The data on yield and yield components of sampled plants were recorded. The harvested plants were and tied into bundles and carried to the threshing floor. The bundles were dried in the open sun for three consecutive days. The seeds were separated from the pods by beating with the bamboo stick and then cleaned, dried and weighed. The weight of dried stover yield was also taken.

3.12 Data collection and sampling procedure

The first crop sampling was done at 15 days after sowing (DAS) and it was continued upto 40 DAS with 5 days interval. At each harvest, five plants were selected randomly from each plot. The selected plants of each plot were collected by cutting plants at ground level. The heights of plants were measured with a meter scale placed on the ground level to top of the leaves. The number of leaves, branches and capsules were recorded separately. The components of plants were oven dried at 70^0 C for 48 hours to record constant dry weights. Above ground dry matter was determined by recording the dry weight of plants except root.

3.13 Plant height (cm)

Plant height was measured from the base of the plant up to the tip of the randomly pre-selected 5 sample plants and the means were calculated.

3.14 Number of population per m^2

The number of population per square meter of each experimental pot was observed. This data collection was done after termination of performing all the thinning operations .

3.15 Number of branches plant^{-1}

Number of branches of 5 plants selected randomly from each treatment was taken and branches of individual plant were then calculated.

3.16 Number of capsules of different branches

Capsules from first, second and third branch of the selected plants were counted separately. The rest of the capsules of other parts were counted together and noted as per treatment.

3.17 Number of capsules plant^{-1}

Total capsules collected from 5 randomly selected plants from each treatment and the number of capsules per plant was calculated.

3.18 Weight of 1000 seeds (g)

1000 seeds were counted randomly from the filled seeds and weighed in an Electric Balance (FX- 300) after drying of seeds on sun for 3 days.

3.19 Seed yield (kg ha^{-1})

The harvested seed from 1 m^2 area of each plot was converted into kg ha^{-1} after drying of seeds on sun for 3 consequitive days.

3.20 Stover Yield (kg ha^{-1})

An area of 1 m^2 was harvested from each plot for stover yield computation and was dried and then weighed and converted to kg ha^{-1}.

3.21 Harvest index (%)

Harvest index (HI) was calculated by the following formula

$$\text{HI \%} = \frac{Grain\ \ yield}{Biological\ \ \ Yield} \times 100$$

3.22 Statistical analysis

The data collected on different parameter were statistically analyzed by using MSTATC computer package to evaluate the level of significance. Mean difference among the treatments were tested with Least Significant Difference (LSD) at 5% level of significance.

CHAPTER IV
RESULTS AND DISCUSSION

This chapter comprises of the presentation and discussion of the results from the experiment - Effect of thinning time and variety on yield performance of sesame .The data have been presented in tabular and graphical form for the convenience of the reader. The result of each parameter has been discussed and possible interpretations have been made whenever necessary in the following heading and sub-headings.

4.1. Plant height (cm)

4.1.1.Effect of thinning time

Effect of thinning time on plant height was found significant and was shown in Fig 1. After 60 DAS the maximum plant height (114.2 cm) was found in plants thinned at 25 DAS (T_3). On the other hand the minimum plant height (95 cm) was found in plants thinnned at 30 DAS (T_4) . Similar phenomenon was observed by Nadeem *et al.* , (2015)

4.1.2. Effect of varieties

Plant height is an important morphological character of crop that showed positive correlation with seed yield of sesame although it may be reversed in other circumstances (Rubio *et al.*, 2004). Effect of varieties on plant height was found significant. Maximum plant height was found in local variety (108 cm) followed by BARI Til 2 (101cm). The effect of varieties on plant height was shown in Fig 2. Local varieties of sesame are usually taller as seen in the experiment. Similar result was observed by Jahan (2015).

4.1.3. Interaction effect of thinning time and Variety

Combined effect of thinning time and variety on plant height was also significant and was shown in Table 3. Maximum plant height (119.0 cm) was found in local variety thinned at 25 DAS (V_2T_3) .Minimum plant height (90.21) cm was found in treatment combination BARI Til 2 when thinned at 30 DAS (V_1T_4) .This is in accordance with findings of Caliskan *et al.* (2004).

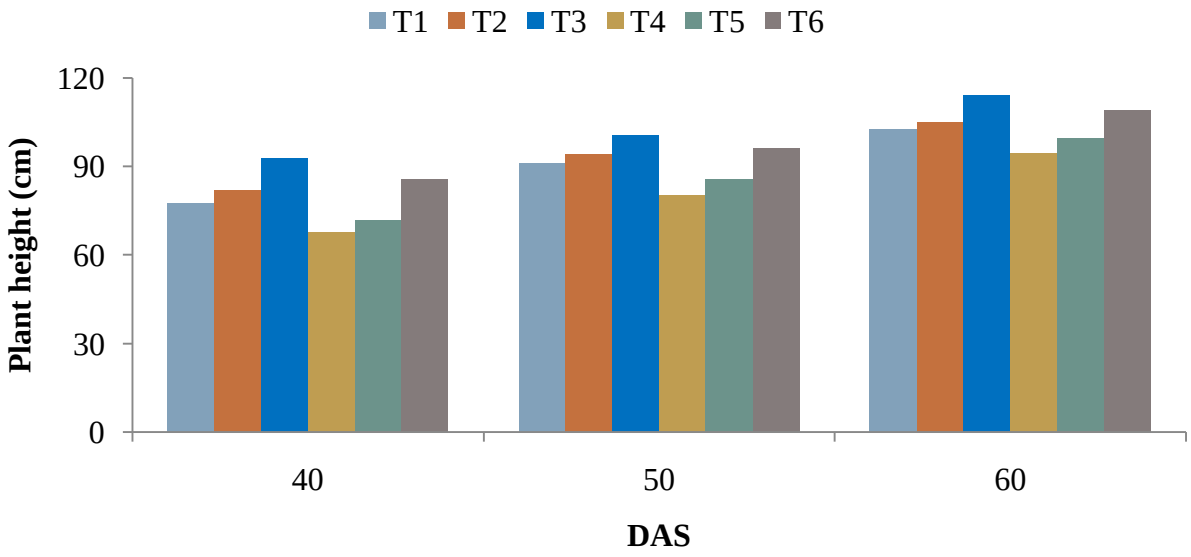

Figure 1. Effect of thinning time on the plant height of sesame at different days after sowing (LSD $_{(0.05)}$ = 5.02, 6.83 and 8.90 at 40, 50 and 60 DAS, respectively**)**

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

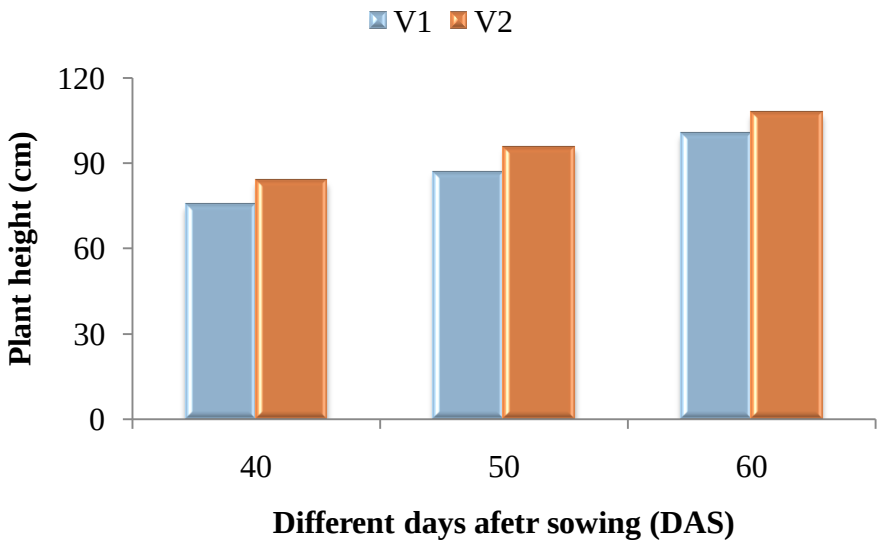

Figure 2. Effect of variety on the plant height of sesame at different days after sowing (LSD $_{(0.05)}$ = 2.54, 3.80 and NS at 40, 50 and 60 DAS, respectively)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

Table 1. Interaction effect of different thinning times and variety on the plant height of sesame at different days after sowing

Treatment combinations	Plant height (cm) at different days after sowing		
	40	50	60
V_1T_1	75.02 ef	86.77 de	99.72 b-e
V_1T_2	78.24 d-f	90.86 b-e	101.9 b-e
V_1T_3	87.15 bc	96.54 a-c	109.4 a-c
V_1T_4	63.00 h	73.92 f	90.21 e
V_1T_5	66.60 gh	81.86 ef	95.96 de
V_1T_6	82.60 b-d	92.11 b-d	105.9 b-d
V_2T_1	80.07 c-e	95.45 a-d	105.6 b-d
V_2T_2	85.90 bc	97.75 a-c	108.2 a-d
V_2T_3	98.15 a	104.6 a	119.0 a
V_2T_4	72.20 fg	86.67 de	98.90 c-e
V_2T_5	77.40 d-f	89.42 c-e	103.1 b-d
V_2T_6	88.83 b	100.3 ab	112.0 ab
$LSD_{(0.05)}$	7.10	9.66	12.59
CV (%)	5.24	6.21	7.1

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

4.2 Dry matter plant^{-1} (g)

4.2.1.Effect of thinning time

Effect of thinning time on dry matter accumulation plant^{-1} was found significant (Fig. 3). After 60 DAS the maximum dry matter (22.2 g) accumulated in plants thinned at 25 DAS. On the other hand, the minimum dry matter plant was (11.5 g) found in plants thinnned at 30 DAS. There was slight decrease in stem dry weight at final harvest. Similar trend was reported by Akter et al. (2016).

4.2.2. Effect of variety

Effect of thinning time on dry matter accumulation plant^{-1} was found significant which shown in Fig.4. The maximum dry matter (19.15 g) accumulated at 60 DAS in local variety (V_2). On the other hand the minimum dry matter plant^{-1} was (16.30 g) found in in BARI TIL 2. The dry weight of stem declined after the attainment of the reproduction period in all the genotypes. This might be due to continuous supply of current assimilates for the development of seeds. This could be attributed to the fact that greater assimilates were partitioned to the capsule production when there is higher nutrient in the root zone. (Haruna, 2011)

4.2.3. Interaction effect of thinning time and variety

Combined effect of thinning time and variety on dry matter accumulation plant^{-1} found significant and was shown in Table 2. Maximum dry weight (23.17 g) was found in V_2T_3. Minimum dry weight (9.33 cm) was found in treatment combination V_1T_4. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results.

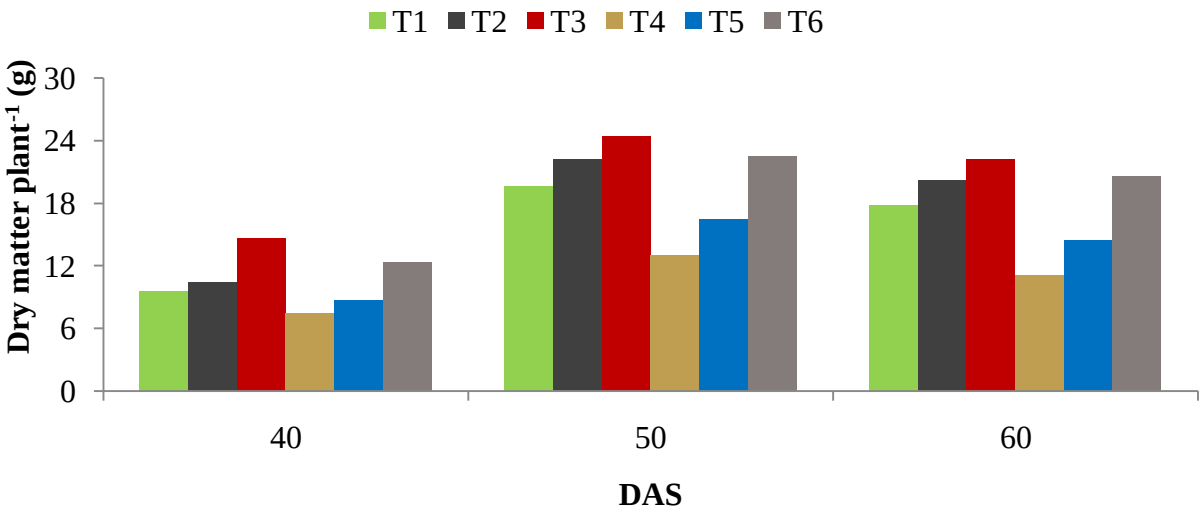

Figure 3. Effect of thinning time on the dry matter plant^{-1} of sesame at different days after sowing (LSD $_{(0.05)}$ = 1.25, 1.77 and 1.67 at 40, 50 and 60 DAS, respectively)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

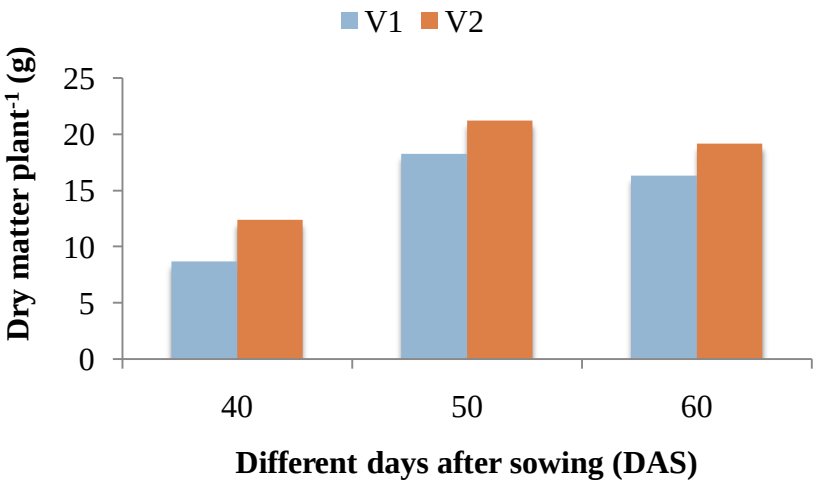

Figure 4. Effect of variety on the dry matter plant^{-1} of sesame at different days after sowing (LSD $_{(0.05)}$ = 0.84, 2.84 and 2.33 at 40, 50 and 60 DAS, respectively

Here,

V_1 = BARI TIL 2

V_2 = Local variety

Table 2. Interaction effect of thinning time and variety on the dry matter weight plant^{-1} of sesame at different days after sowing

Treatment combinations	Dry matter weight plant^{-1} (g) at different days after sowing		
	40	50	60
V_1T_1	7.75 f-h	18.68 e	17.01 f
V_1T_2	8.73 e-g	21.71 b-d	19.76 b-e
V_1T_3	11.70 c	23.61 ab	21.23 a-c
V_1T_4	6.86 h	10.99 g	9.33 h
V_1T_5	7.56 gh	13.23 fg	11.11 gh
V_1T_6	9.37 ef	21.35 b-d	19.35 c-f
V_2T_1	11.46 cd	20.62 c-e	18.49 d-f
V_2T_2	12.21 c	22.78 a-c	20.70 b-d
V_2T_3	17.50 a	25.23 a	23.17 a
V_2T_4	8.06 e-h	15.06 f	12.96 g
V_2T_5	9.71 de	19.73 de	17.79 ef
V_2T_6	15.32 b	23.78 ab	21.81 ab
LSD $_{(0.05)}$	1.76	2.51	2.36
CV (%)	9.83	7.46	7.83

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

4.3 Number of branches plant^{-1}

4.3.1 Effect of thinning time

Difference in number of branches plant^{-1} was found significant for different Thinning time (Fig. 5). Thinning operation reduces the intra specific competition among plants and regulates the plant density where plant density regulates the shape of branches. Early thinning facilitates the branch orientation than later one. T_2 and T_1 showed lower number of long branches But, T_3 showed maximum number of branches plant^{-1} (4.51). Minimum number of branches plant^{-1} 3.15 was found in T_4 plants. Again, T_6 and T_5 showed many small branches with flower. Similar results were observed by Channabasavanna *et al.*, 1992.

4.3.2. Effect of variety

Sesame varieties show variation in their branching pattern . Difference in number of branches plant^{-1} was found significant for different varieties (Fig. 6). Maximum number of branches plant^{-1} was found from local variety V_2 (5.65) followed by 4.55 from BARI Til 2. Maximum branches produce maximum capsule. These results are in general agreement with those of Naim *et al*. (2012)

4.3.3. Interaction effect of thinning time and variety

Effect of thinning time and variety on plant height was also significant (Table 3). Maximum no. of branch (5.73) was found in V_2T_3. Minimum no. of branches (2.8) was found in V_2T_3. Similar results revealed by Jakusco *et al*. (2013)

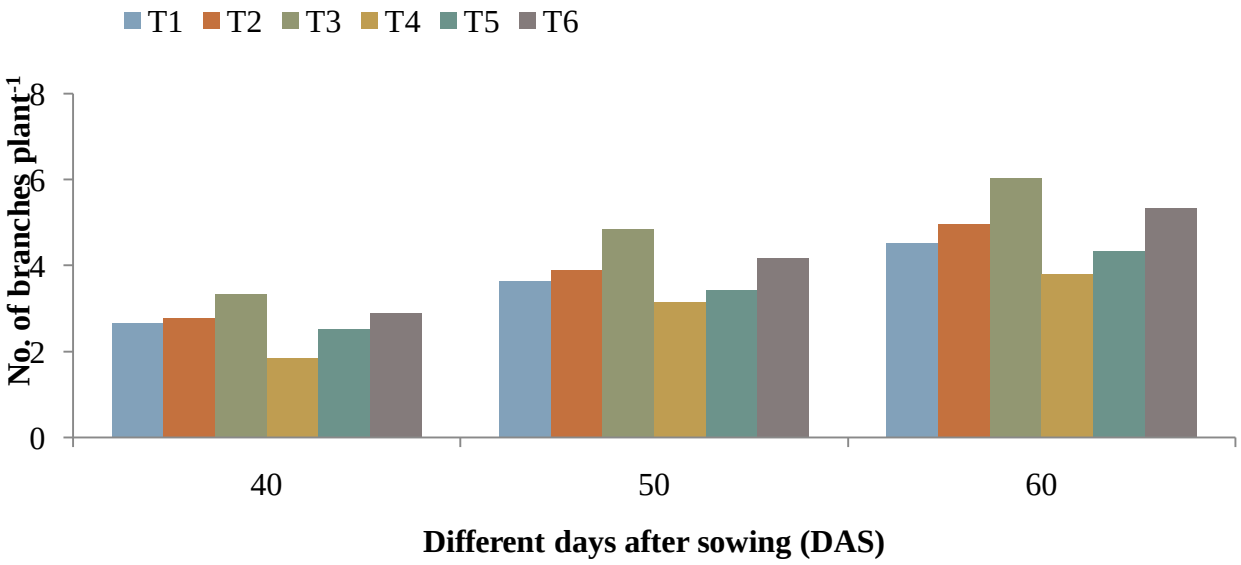

Figure 5. Effect of different thinning time on the no. branches plant^{-1} of sesame at different days after sowing (LSD $_{(0.05)}$ = 0.26, 0.42 and 0.45 at 40, 50 and 60 DAS, respectively)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

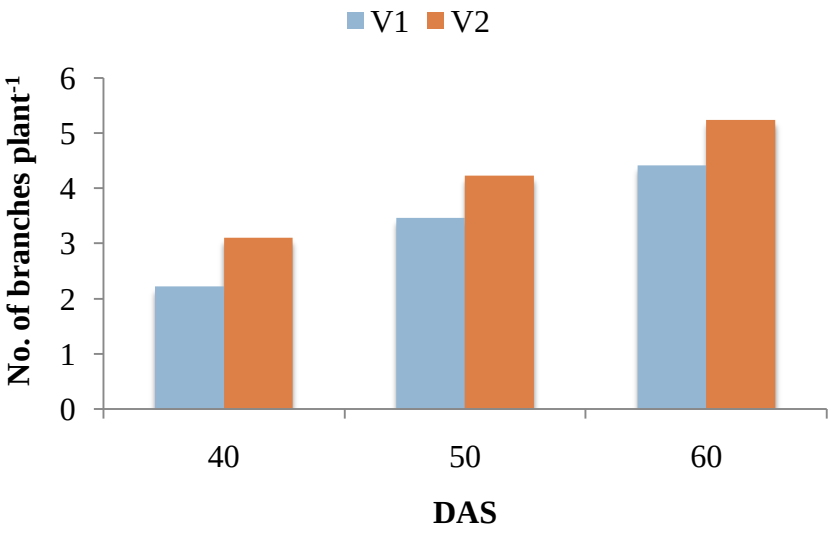

Figure 6. Effect of variety on the no. branches plant^{-1} of sesame at different days after sowing (LSD $_{(0.05)}$ = 0.28, 0.62 and 0.67 at 40, 50 and 60 DAS, respectively)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

Table 3. Interaction effect of thinning time and variety on the branches plant^{-1} of sesame at different days after sowing

Treatment combinations	No. of Branches plant^{-1} at different days after sowing		
	40	50	60
V_1T_1	2.18 cd	3.25 e-g	4.00 fg
V_1T_2	2.33 cd	3.43 d-f	4.33 ef
V_1T_3	3.00 b	4.33 bc	5.73 ab
V_1T_4	1.30 e	2.80 g	3.58 g
V_1T_5	2.05 d	3.13 fg	3.80 fg
V_1T_6	2.43 c	3.83 c-e	5.00 cd
V_2T_1	3.10 b	4.00 b-d	5.00 cd
V_2T_2	3.20 b	4.33 bc	5.57 bc
V_2T_3	3.67 a	5.33 a	6.33 a
V_2T_4	2.33 cd	3.50 d-f	4.00 fg
V_2T_5	3.00 b	3.72 d-f	4.87 de
V_2T_6	3.33 ab	4.50 b	5.67 b
LSD $_{(0.05)}$	0.37	0.59	0.63
CV (%)	8.09	9.06	7.71

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

4.4 Number of capsule of different branches

4.4.1 Effect of thinning time

Thinning time showed significant effect on number of capsule of first, second, third branch and other parts of plants. Early thinned plant produce more branches with more capsules. Here, in case of first branch ,T_3 produce more capsules followed by T_6, T_2, T_1, T_5 and T_4 (8.5, 6.667, 6.333, 5.167, 4.917, 4.500 respectively). Again, in case of second Branch similar variation was found, where T_3 showed statistically significant number of (8.33) capsules. In addition, the third branch appeared with different capsule bearing trend. In that case, T_3 showed highest no. of capsule (8.583) than T_6, T_2, T_1, T_5, T_4 respectively. The number of capsules collected from other parts of plants showed similar variation as previous branches. Highest no. of capsule (30.83) produced by T_3 , and lowest no. of capsule (17) produced by T_4 .

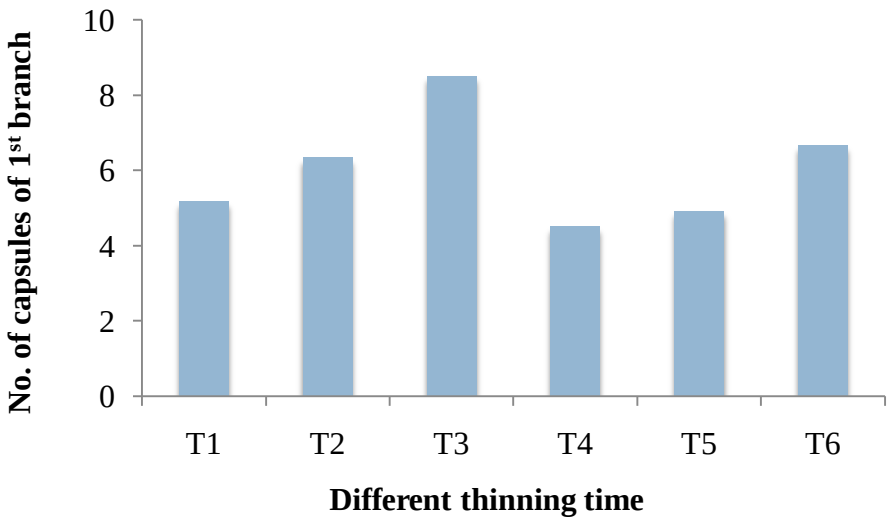

Figure 7. Effect of different thinning time on the no. of capsules per 1st branch of sesame (LSD $_{(0.05)}$ = 0.51)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

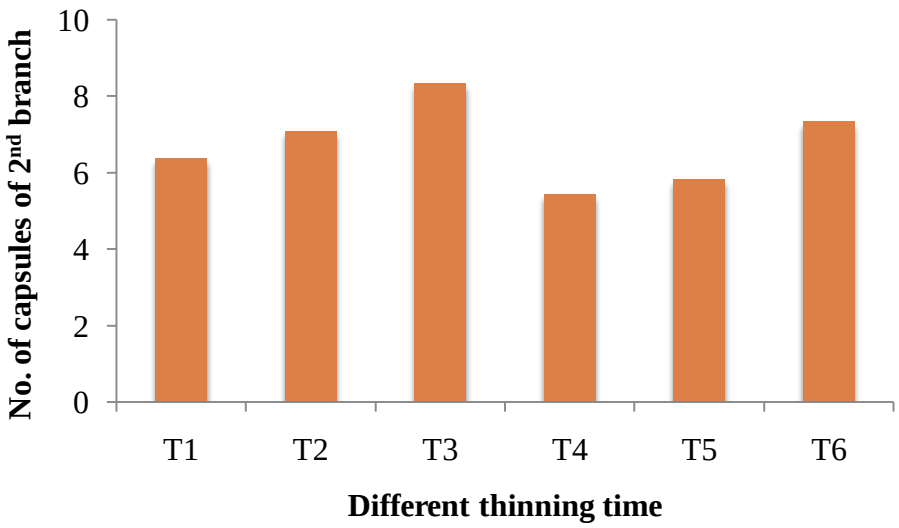

Figure 8. Effect of different thinning time on the no. of capsules per 2nd branch of sesame (LSD $_{(0.05)}$ = 0.66)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

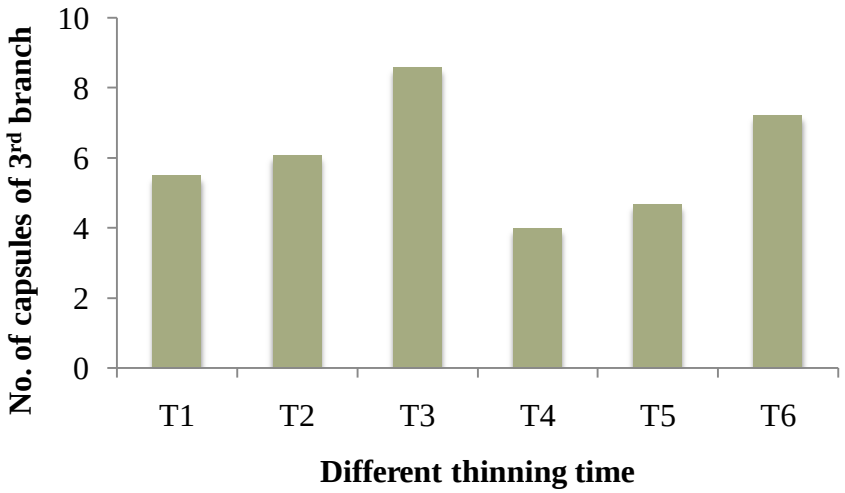

Figure 9. Effect of different thinning time on the no. of capsules per 3rd branch of sesame (LSD $_{(0.05)}$ = 0.52)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

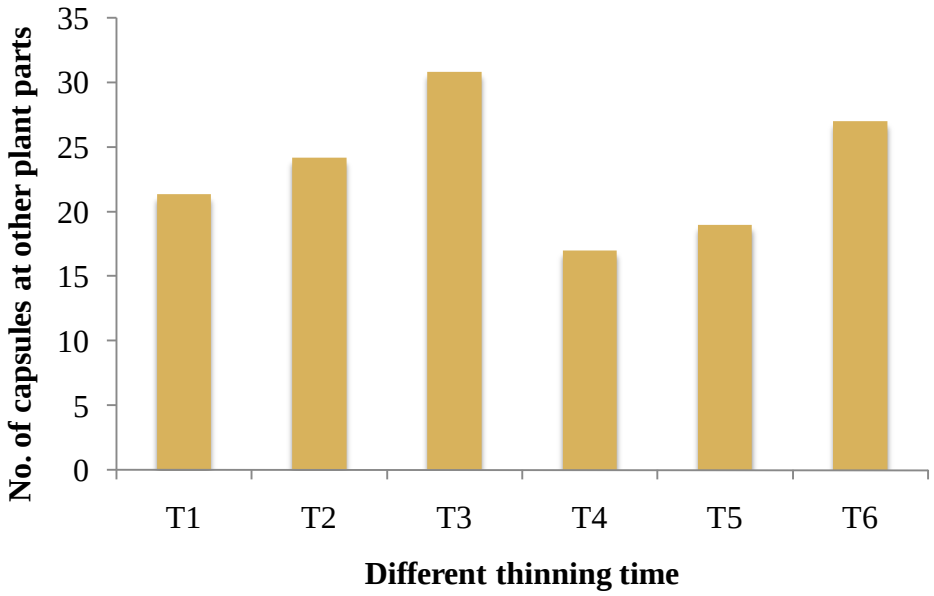

Figure 10. Effect of different thinning time on the no. of capsules at other plant parts of sesame (LSD $_{(0.05)}$ = 1.56)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

4.4.2 Effect of variety

The significant effect was found due to variety on no. of capsules in different branch . Branching is a desired characteristics for a shorter flowering period, higher seed yield and evenness in maturity (Bennet *et al*., 1994). Local variety of sesame (V_2) produce higher no. of capsules in case of first, second, third branches and other parts of the sesame plants (7.06, 7.32, 6.99, 25.72 respectively). When BARI TIL 2 produces capsules in first, second, third branches and other parts of the sesame plants (4.97, 6.14, 5.02, 20.72 respectively). Values for all the treatment attached in Figure no- 11,12, 13 and 14.

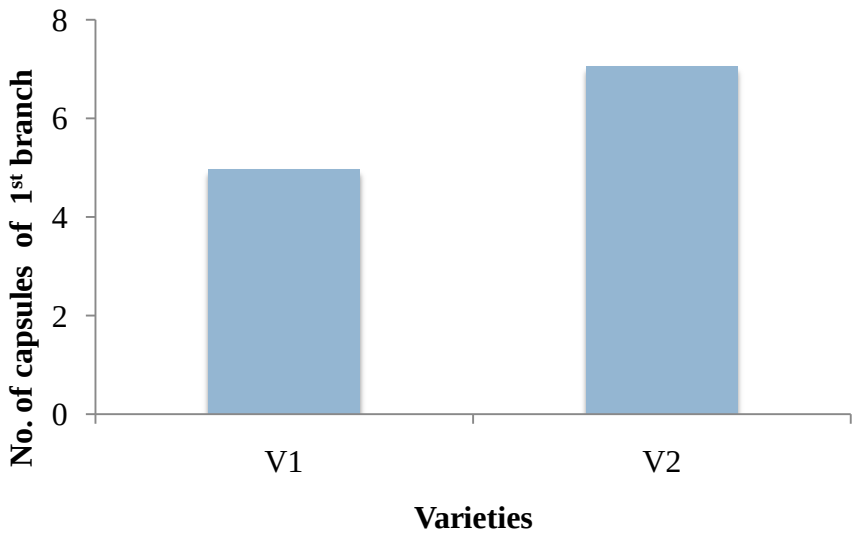

Figure 11. Effect of variety on the no. of capsules per 1st branch of sesame (LSD $_{(0.05)}$ = 0.99)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

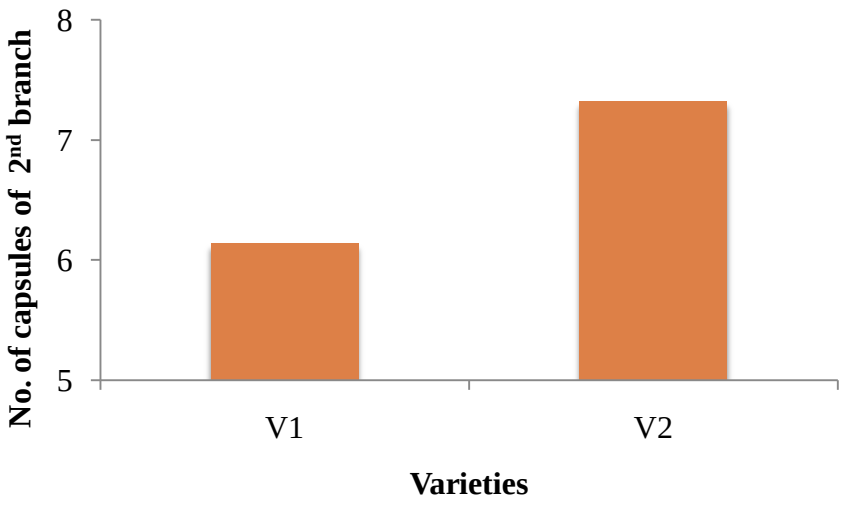

Figure 12. Effect of variety on the no. of capsules of 2nd branch of sesame (LSD (0.05) = 1.09)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

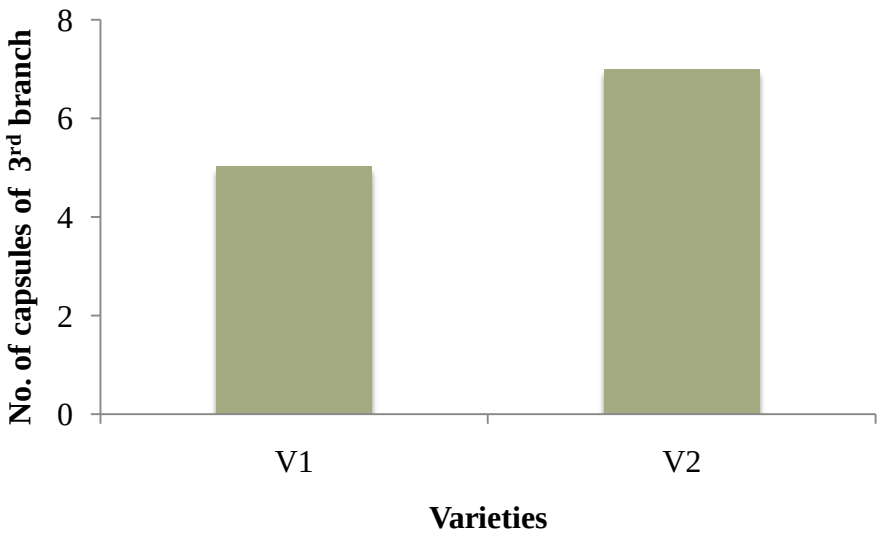

Figure 13. Effect of variety on the no. of capsules of 3rd branch of sesame (LSD $_{(0.05)}$ = 0.88)

Here,

V_1 = BARI TIL 2 and V_2 = Local variety

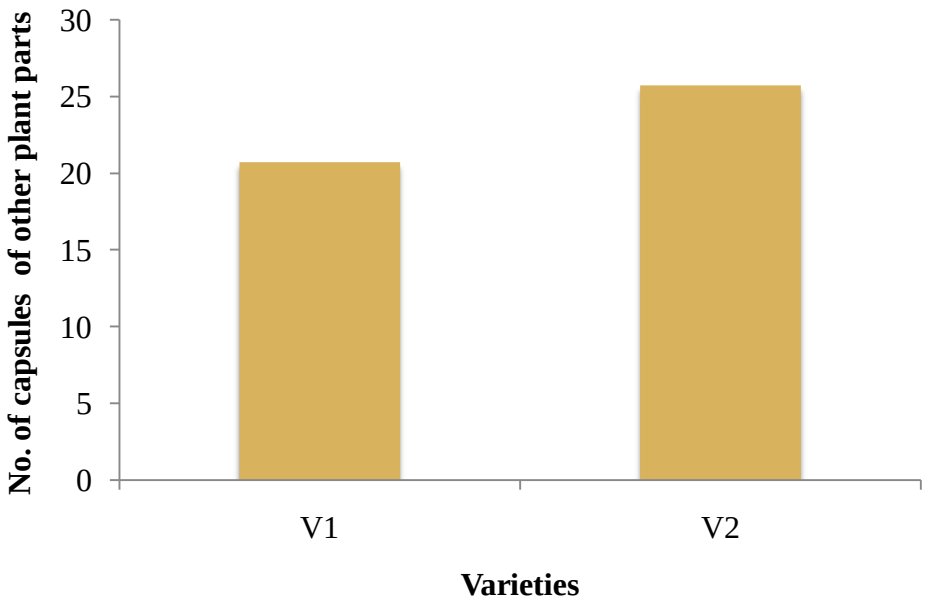

Figure 14. Effect of variety on the no. of capsules of other plant parts of sesame (LSD $_{(0.05)}$ = 1.80)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

4.4.3 Interaction effect of thinning time and variety

Effect of thinning time and variety on no. of capsules in different branches was significant and shown in Table 4. The highest no. of capsules of 1st, 2nd, 3rd branches and other parts of the sesame plant were recorded with V_2T_3 (11.0, 9, 10, 34.67 respectively). V_2T_3 is statistically different from any other treatment combinations. On the other hand the lowest no. of capsules per 1st, 2nd, 3rd branch and other parts of the sesame plant was recorded with the treatment combination V_1T_4 (4.3, 4.67, 3,14 respectively). The results obtained from all other treatment combinations were significantly different compared to highest and lowest results.

Table 4. Interaction effect of variety and different thinning times on the no. of capsules per 1st branch, no. of capsules per 2nd branch, no. of capsules per 3rd branched no. of capsules per other plant parts of sesame

Treatment combinations	No. of capsules per 1st branch	No. of capsules per 2nd branch	No. of capsules per 3rd branch	No. of capsules of other plant parts
V_1T_1	4.67 ef	5.67 fg	4.67 h	19.00 g
V_1T_2	5.00 d-f	6.83 c-e	5.53 fg	23.33 de
V_1T_3	6.00 c	7.67 bc	7.17 c	27.00 bc
V_1T_4	4.30 f	4.67 h	3.00 i	14.00 h
V_1T_5	4.50 f	5.33 gh	3.67 i	16.00 h
V_1T_6	5.33 c-e	6.67 de	6.10 d-f	25.00 cd
V_2T_1	5.67 cd	7.07 b-e	6.33 de	23.67 de
V_2T_2	7.67 b	7.33 b-d	6.63 cd	25.00 cd
V_2T_3	11.00 a	9.00 a	10.00 a	34.67 a
V_2T_4	4.70 ef	6.20 e-g	5.00 gh	20.00 fg
V_2T_5	5.33 c-e	6.33 ef	5.67 e-g	22.00 ef
V_2T_6	8.00 b	8.00 b	8.33 b	29.00 b
LSD (0.05)	**0.72**	**0.93**	**0.73**	**2.20**
CV (%)	**7.06**	**8.16**	**7.14**	**5.57**

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

4.5 Number of capsule plant^{-1}

4.5.1 Effect of thinning time

Number of capsule per plant was significantly influenced by population density of the plants (Fig 15). It was observed that T_3 at harvest showed the highest number of capsules per plant (56). T_6 showed second highest no. of capsules (46). Late thinning caused longer height with more no of capsules. On the other hand the lowest number of capsules per plant (31.00) was recorded with T_4. Similar results observsd by Ali *et al*. (2005).

4.5.2 Effect of variety

Sesame variety had great influence on number of capsules per plant at harvest (Figure- 16). It was observed that V_2 (Local Variety) showed the highest number of capsules per plant (47). On the other hand the lowest number of capsules plant^{-1} (37) was recorded with. These results show general agreement with Akter *et al* (2016).

4.5.3 Interaction effect of thinning time and variety

The interaction of Thinning Time and Variety on the number of capsules per plant had significant effect at harvest (Table 5). It was observed that the highest number of capsules per plant was recorded with the treatment combination of V_2T_3 (64.67) which is significantly different from other treatment combinations. On the other hand the lowest number of capsules per plant (25.97) was recorded with the treatment combination of V_1T_4 at harvest. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results.

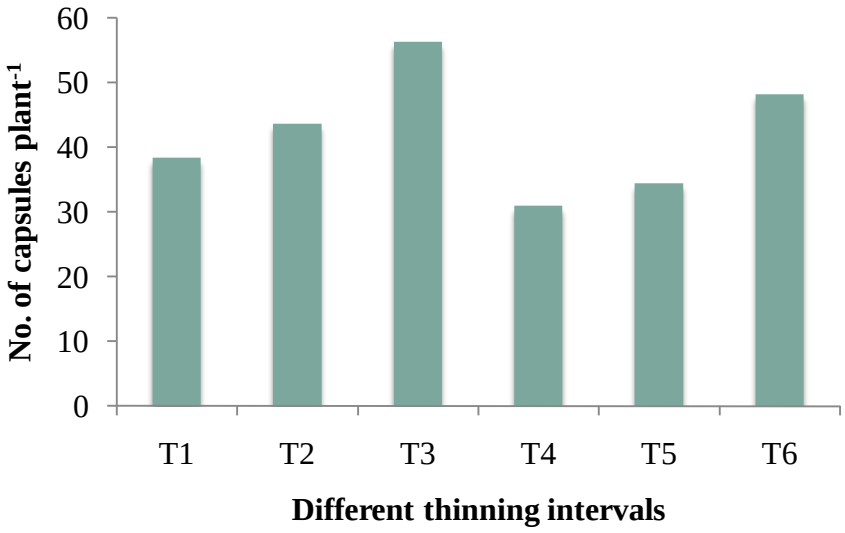

Figure 15. Effect of different thinning time on the no. of capsules plant^{-1} of sesame (LSD $_{(0.05)}$ = 2.26)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

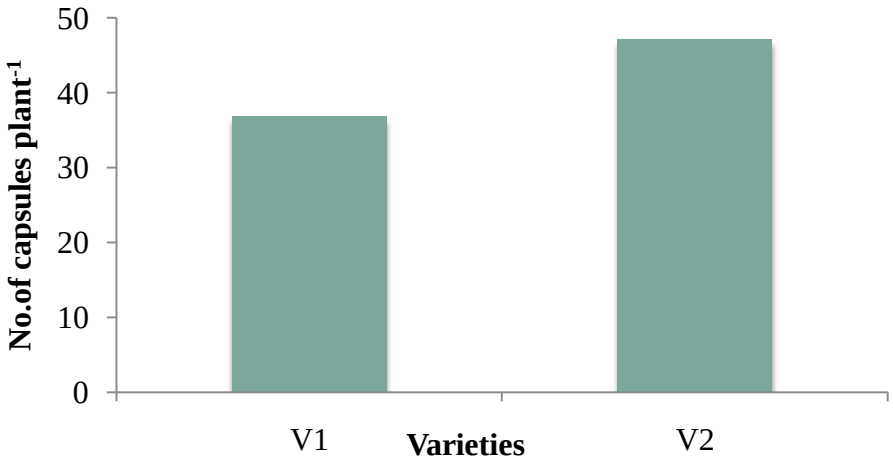

Figure 16. Effect of variety on the no. of capsules plant^{-1} of sesame (LSD $_{(0.05)}$ = 3.36)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

Table 5. Interaction effect of thinning time and variety on the no. of capsules per plant of sesame

Treatment combinations	No. of capsules plant^{-1}
V_1T_1	34.00 f
V_1T_2	40.70 de
V_1T_3	47.83 c
V_1T_4	25.97 h
V_1T_5	29.50 g
V_1T_6	43.10 d
V_2T_1	42.73 d
V_2T_2	46.63 c
V_2T_3	64.67 a
V_2T_4	35.90 f
V_2T_5	39.33 e
V_2T_6	53.33 b
LSD $_{(0.05)}$	**3.20**
CV (%)	**4.48**

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

4.6 Weight of 1000 seeds (g)

4.6.1 Effect of thinning time

Weight of 1000 seeds was significantly influenced by different thinning time (Fig. 17). It was observed that T_3showed the highest 1000 seed weight (2.933 g). On the other hand the lowest 1000 seed weight (2.115 g) was recorded with T_4 (Thinned at 30 DAS) which was not significantly different from T_5. Similar results were observed by Jakusko *et al*. (2013) in sesame.

4.6.2 Effect of variety

Variety of sesame had the great influence on 1000 seed weight at harvest (Figure- 18). It was observed that V_2 (Local variety) showed the highest 1000 seed weight (2.68 g). On the other hand the lowest number of 1000 seed weight (2.34 g) was recorded with V_1 (BARI TIL 2). Similar results were observed by Ali et al. (2005).

4.6.3 Interaction effect of thinning time and variety

The interaction effect of thinning time and variety on 1000 seed weight had significant effect (Table 6). It was observed that the highest 1000 seed weight was recorded with the treatment combination of V_2T_3 (2.993 **g**) which was statisticaly similar with V_1T_3, V_2T_2, V_2T_6. On the other hand the lowest 1000 seed weight (1.993 g) was recorded with the treatment combination of V_1T_4 which was similar with V_1T_5 .

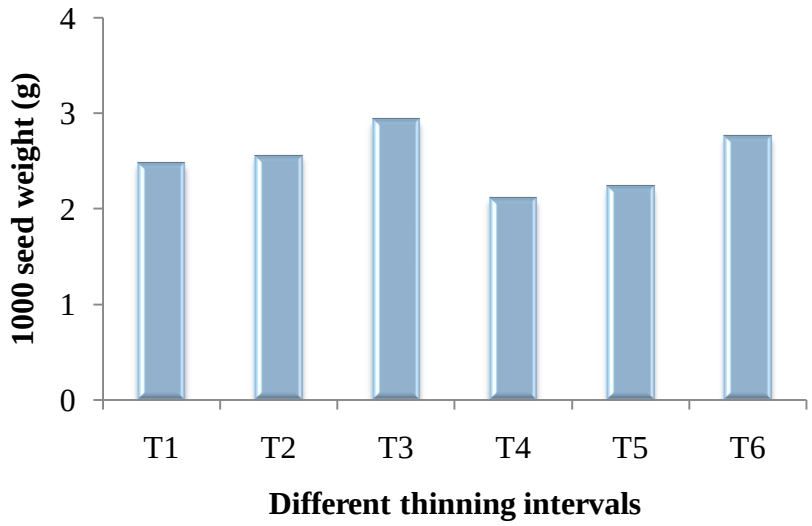

Figure 17. Effect of different thinning time on the 1000 seed weight of sesame ($LSD_{(0.05)}$ = 0.13)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

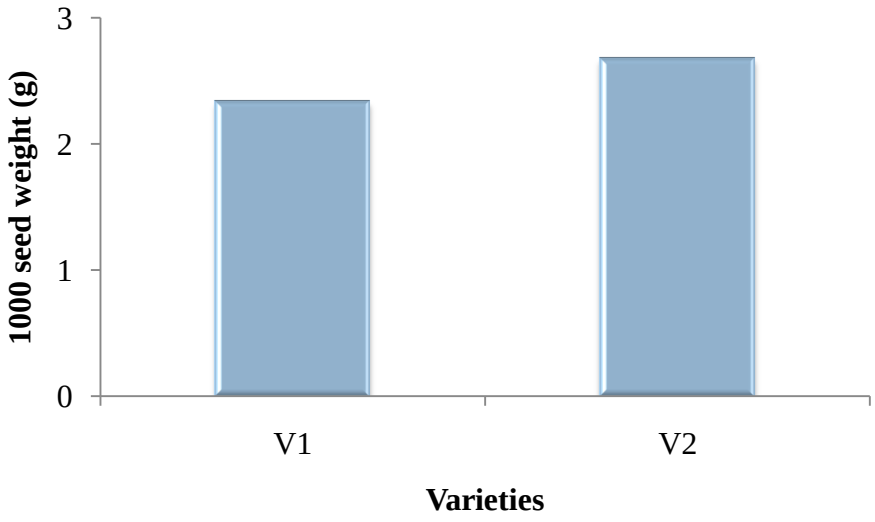

Figure 18. Effect of variety on the 1000 seed weight of sesame (LSD $_{(0.05)}$ = 0.26)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

Table 6. Interaction effect of thinning time and variety on 1000 seed weight

Treatment combinations	1000 seed weight (g)
V_1T_1	2.22 de
V_1T_2	2.25 de
V_1T_3	2.87 ab
V_1T_4	1.99 f
V_1T_5	2.12 ef
V_1T_6	2.61 c
V_2T_1	2.73 bc
V_2T_2	2.87 ab
V_2T_3	2.99 a
V_2T_4	2.24 de
V_2T_5	2.35 d
V_2T_6	2.91 ab
LSD $_{(0.05)}$	**0.19**
CV (%)	**4.38**

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

4.7 Seed Yield (kg ha^{-1})

4.7.1 Effect of thinning time

Seed yield (kg ha^{-1}) was significantly influenced by Thinning time (Fig. 19). It was observed that T_3 showed the highest yield (656 kg ha^{-1}). On the other hand the lowest yield (387.10 kg ha^{-1}) was recorded with T_4. The result obtained from T_1 (426) showed intermediate results compared to all other population density. The similar trends were observed by Ali *et al*. (2007).

4.7.2 Effect of variety

Variety had the great influence on sesame seed yield (kg ha^{-1}) (Fig. 20). It was observed that Local variety showed the highest yield (590 kg ha^{-1}). On the other hand the lowest yield (464 kg ha^{-1}) was recorded with BARI TIL 2.

4.7.3 Interaction effect of thinning time and variety

The interaction effect of thinning time and variety on seed yield (kg ha^{-1}) had significant effect (Table 6). It was observed that the highest yield was recorded with the treatment combination of V_2T_3 (761.80 kg ha^{-1}). On the other hand the lowest yield (387.10 kg ha^{-1}) was recorded with the treatment combination of V_1T_4 . The results obtained from all other treatment combinations were significantly different compared to highest and lowest results.

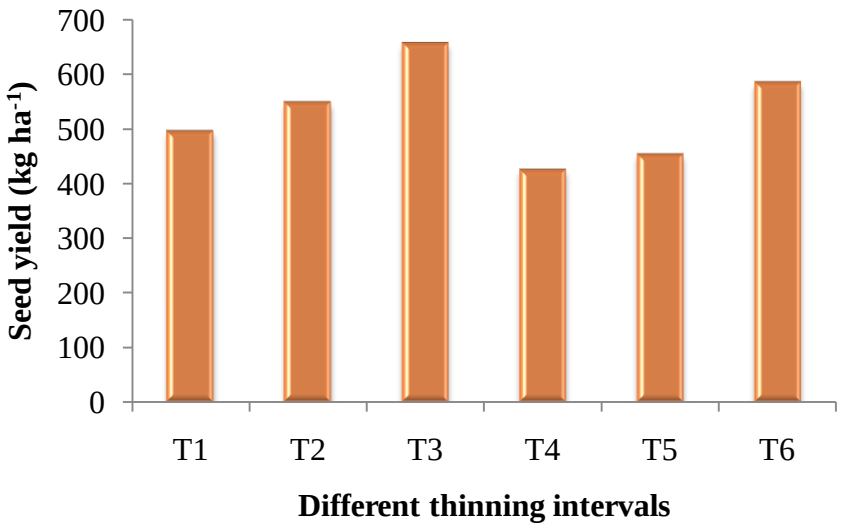

Figure 19. Effect of different thinning time on the seed yield of sesame (LSD $_{(0.05)}$ = 45.61)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

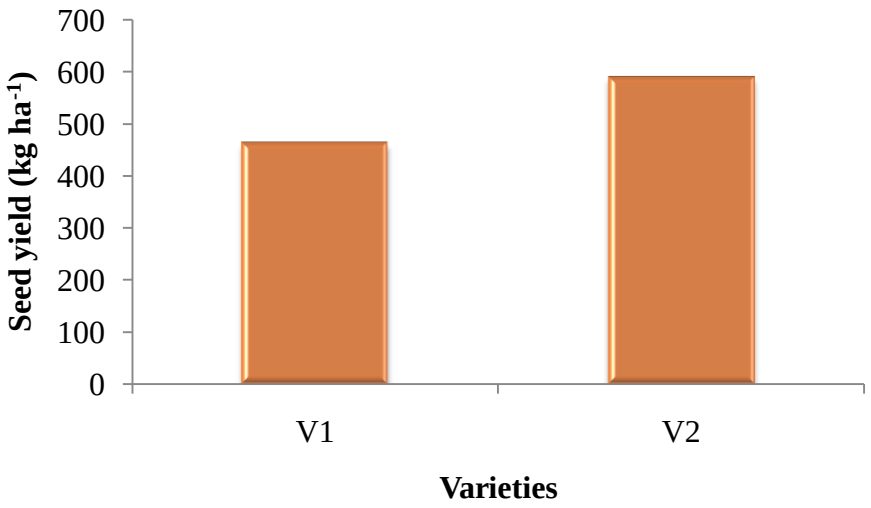

Figure 20. Effect of variety on the seed yield of sesame (LSD $_{(0.05)}$ = 97.35)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

Table 7. Interaction effect of thinning time and variety on seed yield of sesame

Treatment combinations	Seed yield (kg ha^{-1})
V_1T_1	444.60 e-g
V_1T_2	476.90 de
V_1T_3	550.80 c
V_1T_4	387.10 g
V_1T_5	400.00 fg
V_1T_6	525.50 cd
V_2T_1	547.20 c
V_2T_2	619.00 b
V_2T_3	761.80 a
V_2T_4	464.40 d-f
V_2T_5	506.50 c-e
V_2T_6	643.80 b
LSD $_{(0.05)}$	**64.51**
CV (%)	**7.18**

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

4.8 Stover yield (kg ha^{-1})

4.8.1 Effect of thinning time

Stover yield was significantly influenced by thinning Time (Fig. 21). The highest stover yield (2491kg ha^{-1}) was observed from T_3. On the other hand the lowest stover yield (1572.28 kg ha^{-1}) was recorded with T_4 (plant thinned at 30DAS). Similar result observed by Alim *et al*. (2009)

4.8.2 Effect of variety

Different variety of sesame had the great influence on stover yield (Fig. 22). It was observed that V_2 (Local variety) showed the highest stover yield (2233 kg ha^{-1}). On the other hand the lowest stover yield (1994 kg ha^{-1}) was recorded with V_1 (BARI TIL 2).

4.8. 3 Interaction effect of thinning time and variety

The interaction effect of thinning time and variety on stover yield (kg ha^{-1}) had significant effect (Table 7). It was observed that the highest stover yield was recorded with the treatment combination of V_2T_3 (2693 kg ha^{-1}). On the other hand the lowest stover yield (1473 kg ha^{-1}) was recorded with the treatment combination of V_1T_4 which was statistically similar with V_1T_5. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results.

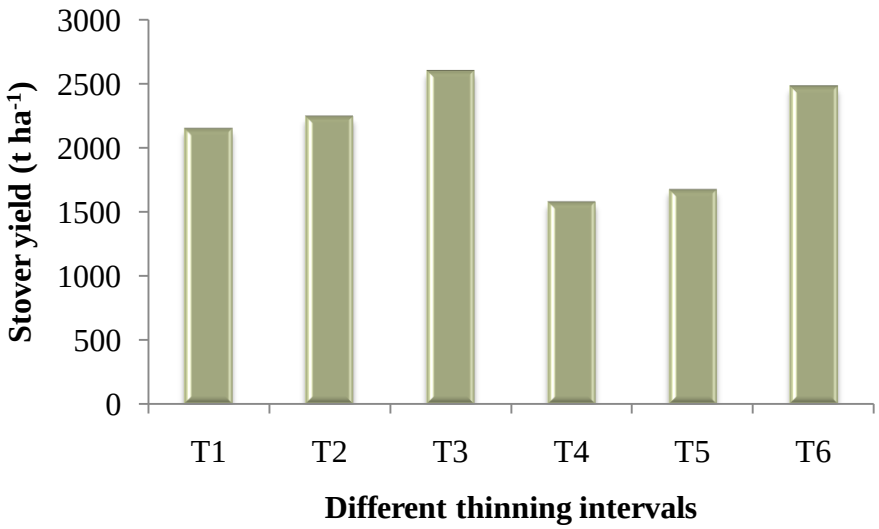

Figure 21. Effect of different thinning time on the stover yield of sesame (LSD $_{(0.05)}$ = 211.20)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

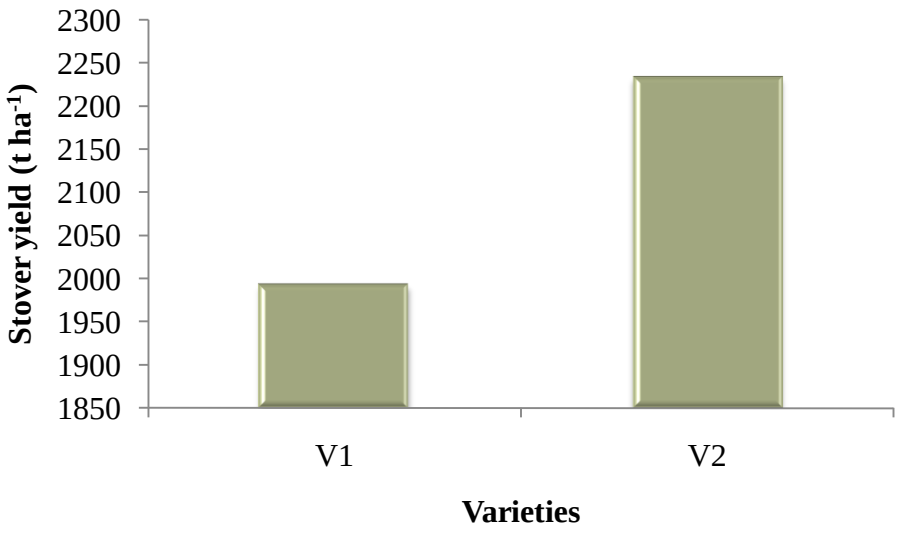

Figure 22. Effect of variety on the stover yield of sesame (LSD $_{(0.05)}$ = 228.64)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

Table 8. Interaction effect of thinning time and variety on stover yield of Sesame

Treatment combinations	Stover yield (kg ha^{-1})
V_1T_1	2006 ef
V_1T_2	2165 de
V_1T_3	2488 a-c
V_1T_4	1473 h
V_1T_5	1483 h
V_1T_6	2350 b-d
V_2T_1	2280 c-e
V_2T_2	2307 b-d
V_2T_3	2693 a
V_2T_4	1670 gh
V_2T_5	1857 fg
V_2T_6	2593 ab
LSD $_{(0.05)}$	**298.70**
CV (%)	**8.3**

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

4.9 Biological yield (kg ha^{-1})

4.9.1 Effect of thinning time

Biological yield was significantly influenced by thinning time (Fig. 23). The highest biological yield (3247 kg ha^{-1}), was observed from T_3(plants thinned at 25 DAS) .On the other hand, the lowest biological yield (1997 kg ha^{-1}) was recorded with T_4 (plant thinned at 30DAS). These results are in general agreement with Ali *et al*. (2005). The result obtained from all other treatment combinations were significantly different compared to highest and lowest results.

4. 9.2 Effect of variety

Different variety of sesame had the great influence on biological yield (Fig. 24). It was observed that (Local variety) showed the highest stover yield (2824 kg ha^{-1}) . On the other hand the lowest stover yield (2458 kg ha^{-1}). was recorded with (BARI TIL 2).

4.9. 3 Interaction effect of thinning time and variety

The interaction effect of thinning interval and variety on stover yield (kg ha^{-1}) had significant effect (Table 7). It was observed that the highest stover yield was recorded with the treatment combination of V_2T_3 (3455 kg ha^{-1}). On the other hand the lowest stover yield (1860 kg ha^{-1}) was recorded with the treatment combination of V_1T_4 which was statistically similar with V_1T_5 . The results obtained from all other treatment combinations were significantly different compared to highest and lowest results.

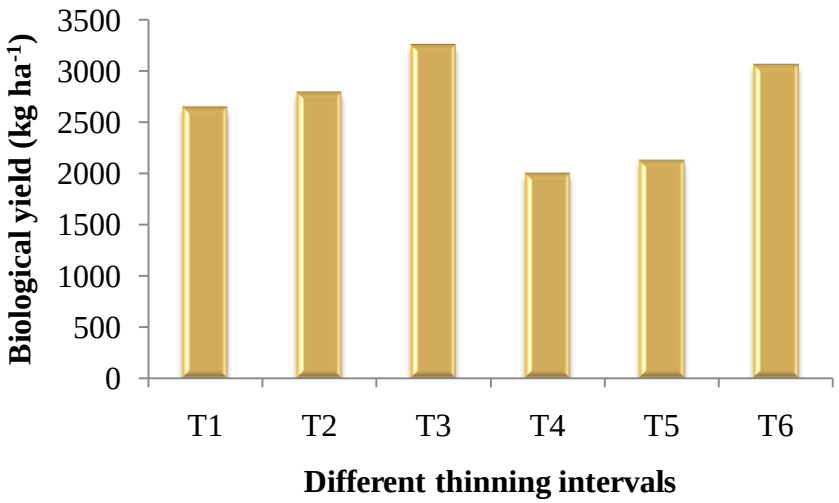

Figure 23. Effect of different thinning time on the biological yield of sesame (LSD $_{(0.05)}$ = 224.00)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

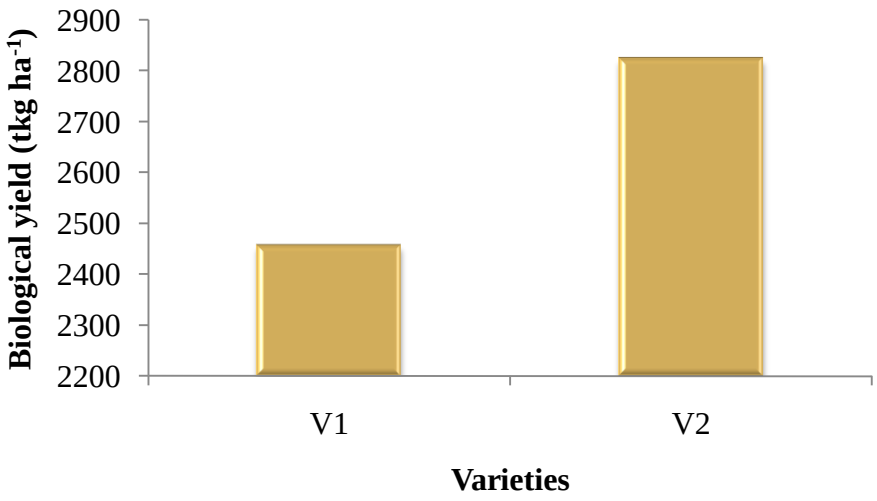

Figure 24. Effect of variety on the biological yield of sesame (LSD $_{(0.05)}$ = 296.52)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

Table 9. Interaction effect of thinning time and variety on biological yield of sesame

Treatment combinations	Biological yield (kg ha^{-1})
V_1T_1	2450 ef
V_1T_2	2642 de
V_1T_3	3038 bc
V_1T_4	1860 g
V_1T_5	1883 g
V_1T_6	2875 cd
V_2T_1	2827 cd
V_2T_2	2926 b-d
V_2T_3	3455 a
V_2T_4	2134 fg
V_2T_5	2363 ef
V_2T_6	3237 ab
LSD $_{(0.05)}$	**316.80**
CV (%)	**7.04**

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

4.10 Harvest index (%)

4.10.1 Effect of thinning time

Harvest index was significantly influenced by Thinning Time (Fig. 25). The highest Harvest Index (21%) was observed from T_5 which was similar with T_4 . On the other hand the lowest Harvest Index (19%) was recorded with T_1 also statistically similar with T_6. These results are in general agreement with Nadeem *et al*. (2015). The result obtained from all other treatment combinations were significantly different compared to highest and lowest results.

4.10.2 Effect of variety

Different variety of sesame had the great influence on Harvest index (Fig. 26). It was observed that (Local variety) showed the highest harvest index (21%). On the other hand the lowest harvest index (19%) was recorded with BARI TIL 2.

4.10. 3 Interaction effect of thinning time and variety

The interaction effect of thinning time and variety on harvest index (%) is significant (Table 7). It was observed that the highest harvest index was recorded with the treatment combination of V_2T_3 (22.03 %) , but it was statisticaly similar with V_2T_2, V_2V_5, V_2T_5, V_2T_6,V_1T_4, V_1T_5 . On the other hand the lowest harvest index (18.05 %) was recorded with the treatment combination of V_1T_2 which was also statistically similar withV_1T_1 and V_1T_3 .

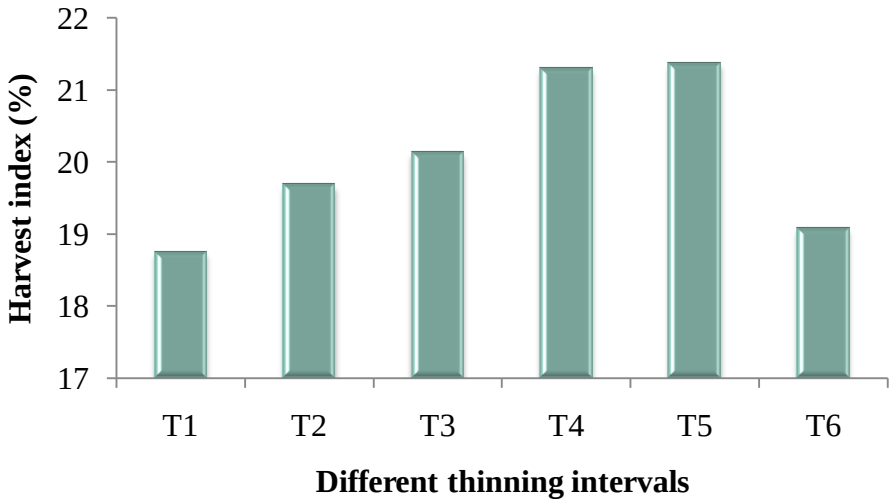

Figure 25. Effect of different thinning time on the harvest index of sesame (LSD $_{(0.05)}$ = 1.52)

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

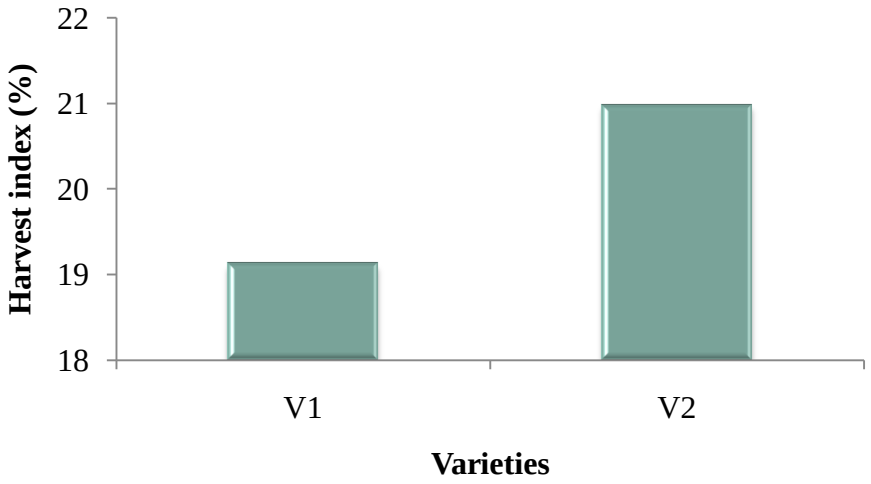

Figure 26. Effect of variety on the harvest index of sesame (LSD $_{(0.05)}$ = 1.27)

Here,

V_1 = BARI TIL 2

V_2 = Local variety

Table 10. Interaction effect of thinning time and variety on the Harvest index of sesame

Treatment combinations	Harvest index (%)
V_1T_1	18.15 c
V_1T_2	18.05 c
V_1T_3	18.23 c
V_1T_4	20.82 ab
V_1T_5	21.26 ab
V_1T_6	18.24 c
V_2T_1	19.35 bc
V_2T_2	21.32 ab
V_2T_3	22.03 a
V_2T_4	21.79 a
V_2T_5	21.50 ab
V_2T_6	19.93 a-c
LSD $_{(0.05)}$	**2.16**
CV (%)	**6.31**

Here,

T_1 = Thinning at 15 DAS

T_2 = Thinning at 20 DAS

T_3 = Thinning at 25 DAS

T_4 = Thinning at 30 DAS

T_5 = Thinning at 35 DAS

T_6 = Thinning at 40 DAS

V_1 = BARI TIL 2

V_2 = Local Variety

CHAPTER V

SUMMARY AND CONCLUSION

The experiment was conducted at the Sher-e-Bangla Agricultural University Farm, Dhaka-1207 , during Kharif-1 (March – June), 2017 to study the effect of thinning time and variety on yield performance of sesame. The experiment was carried out with split plot design with two factors assigned in 3 m x 1.5 m area of unit plots and replicated thrice. Two factors: (A) variety and (B) Thinning time were chosen. The varieties were BARI TIL 2 and Local variety with thinning time viz. (1) Thinning at 15 DAS (T_1), (2) Thinning at 20 DAS (T_2), (3) Thinning at 25 DAS (T_3), (4) Thinning at 30 DAS (T_4), (5) Thinning at 35 DAS (T_5) and (6) Thinning at 40 DAS (T_6).

The seeds were sown on 29 March, 2017 and the crop was harvested on 17 June, 2017. The data were collected plot wise on plant height (cm), number of primary branches plant^{-1}, number of pods plant^{-1}, weight of 1000-seed (g), seed yield (kg ha^{-1}) and stover yield (kg ha^{-1}) and Harvest Index (%). Data were analyzed using MSTAT-C software package program. The mean differences among the treatments were compared by Least Significant Different Test at 5% level of significance.. The results of the experiment are stated below.

Effect of thinning time and variety and their interaction of sesame according to the experiment had significant effect on plant height (cm), dry weight plant^{-1} , number of branches plant^{-1}, number of capsules plant^{-1}, number of capsules m^{-2}, number of seeds capsule^{-1}, 1000 seed weight (g), yield plant^{-1} (g), total yield (kg ha^{-1}), stover yield (kg ha^{-1}) and harvest index (%). The results showed that effect of thinning time was significant on various plant character of sesame. Late thinning showed increased plant height and here plants thinning at 25 DAS (T_3) showed highest plant height (114.2 cm) at harvest and dry weight m^{-2} (22.23 g) were also shown by this treatment. Again, in the case of thinning at 25 DAS (T_3) the highest number of branches plant^{-1} (4.88), dry weight plant^{-1} (22.2g) and seed yield (656 kg). On the other hand the shortest plant (95 cm) at harvest, dry weight plant^{-1}

(11.5 g), number of capsules plant^{-1} (25.97) and stover yield (1473 kg ha^{-1}) were found with thinning at 30 DAS (T_4).

Variety also showed significant effect on yield and yield contributing character of sesame plant. The tallest plant height (108 cm) was obtained with V_2 (Local variety) where the shortest plant (90.21cm) from V_1 (BARI TIL 2) treatment. The highest number of branches plant^{-1} (5.56), dry weight plant^{-1} (19.15 g), number of capsules plant^{-1} (47), 1000 seed weight (2.68 g), seed yield (590 kg ha^{-1}), stover yield (2233 kg ha^{-1}) were obtained from Local variety) .

Plant height (cm), number of branches plant^{-1}, leaf area index, dry weight plant^{-1}, dry weight m^{-2} (g), crop growth rate, number of capsules plant^{-1}, number of capsules m^{-2}, number of seeds capsule^{-1}, 1000 seed weight (g), yield plant^{-1} (g), total yield (kg ha^{-1}), stover yield (kg ha^{-1}) and harvest index were also significantly affected by different interaction effect of thinning time and variety of sesame. The tallest plant (119.0 cm) was produced by the combined effect of V_2T_3 (Local variety + thinning at 25 DAS) and the smallest (90.21cm) by V_1T_4 (BARI TIL 2+ thinning at 30 DAS). The highest number of branches plant^{-1} (5.73), dry weight plant^{-1} (23.17g), stover yield (2693 kg ha^{-1}) , and seed yield (761.80 kg ha^{-1}) was recorded with the combined effect of V_2T_3 .

The highest number of capsules plant^{-1} (64.67), 1000 seed weight (2.99 g), stover yield (2693 kg ha^{-1}) and harvest index (22.03%) were also obtained with the combined effect of V_2T_3 (Local variety + thinning at 25 DAS).

The lowest dry weight plant^{-1} (9.33g), and stover yield (1473 kg ha^{-1}) were recorded with the combined effect of V_1T_4 **(**BARI TIL 2+Thinning at 30 DAS**)**. The lowest number of capsules plant $^{-1}$(25.97), seed yield (387.10 kg ha^{-1}), 1000 seed weight (1.993 g), harvest index (20.82) respectively were obtained with the combined effect of the previous combination V_1T_4 **(**BARI TIL 2+thinning at 30 DAS**)**.

Considering all the parameters studied the following conclusion may be drawn-

 The effective thinning time on yield performance of sesame was observed by the thinning time T_3 (Thinning at 25 DAS) treatment.

 The effective variety on yield performance of sesame was observed by the variety, V_2 (Local variety) treatment.

 The effective interaction effect on thinning time and yield performance of sesame was observed by the combined effect of V_2T_3 (Local variety Thinning at 25 DAS).

However, to reach a specific conclusion and recommendation, more research work on sesame should be done in different Agro-ecological zones of Bangladesh.

CHAPTER VI
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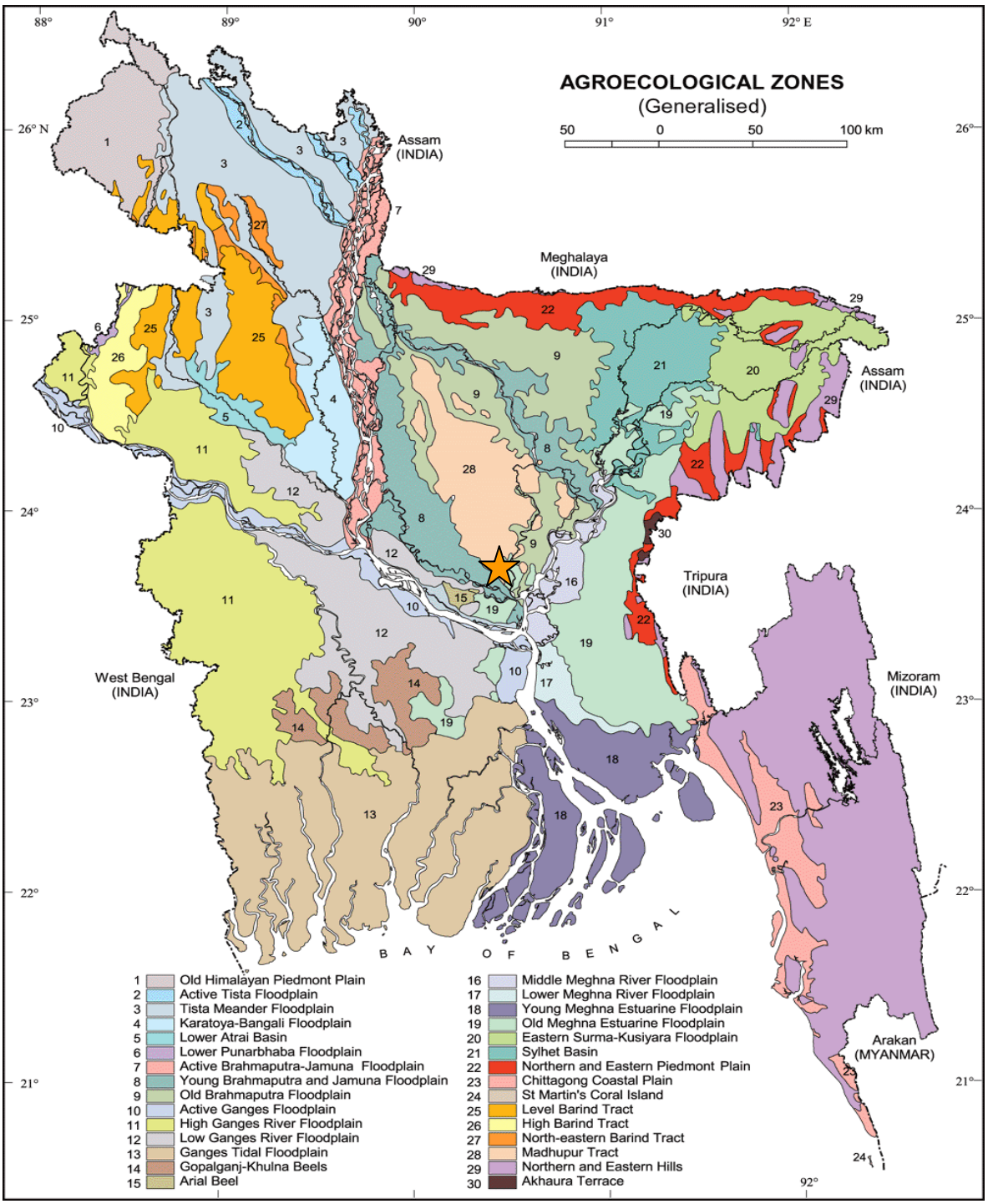
APPENDICES

Appendix I. Map showing the experimental site under study



Appendix II. Physical characteristics of field soil analyzed by Soil Resources Development Institute (SRDI) laboratory, Khamarbari, Farmgate, Dhaka

A. Morphological characteristics of the experimental field

Morphological features	Characteristics
Location	Agronomy field, SAU, Dhaka
AEZ	Madhupur Tract (28)
General Soil Type	Shallow red brown terrace soil
Land type	High land
Soil series	Tejgaon
Topography	Fairly leveled
Flood level	Above flood level
Drainage	Well drained

Source: Soil Resources Development Institute (SRDI)

B. Physical and chemical properties of the initial soil

Characteristics	Value
% Sand	27
% Silt	43
% clay	30
Textural class	Silty-clay
pH	5.6
Organic carbon (%)	0.45
Organic matter (%)	0.78
Total N (%)	0.03
Available P (ppm)	20.00
Exchangeable K (me/100 g soil)	0.10
Available S (ppm)	45

Source: Soil Resources Development Institute (SRDI)

Appendix III. Effect of thinning time and variety and their interaction on plant height (cm) of sesame at different days after sowing

Plant Height				
Source of Variation	**Degrees of Freedom**	**Mean Square Value**		
		40 DAS	**50 DAS**	**60 DAS**
Replication	2	3.476	67.730	13.403
Variety (V)	1	623.584*	678.689*	478.151*
Error	2	3.140	7.009	141.932
Thinning Time (T)	5	503.820*	326.352*	289.420*
VxT	5	8.889*	6.488*	3.411*
Error	20	17.375	32.150	54.664
Total	35			

Appendix IV. Effect of thinning time and variety and their interaction on plant dry weight (g) of sesame at different days after sowing

DW				
Source of Variation	**Degrees of Freedom**	**Mean Square Value**		
		40 DAS	**50 DAS**	**60 DAS**
Replication	2	0.684	0.188	1.756
Variety (V)	1	124.137*	77.675*	19.243*
Error	2	0.347	3.923	0.667
Thinning Time (T)	5	40.468*	110.255*	26.831*
VxT	5	5.448	6.125	0.475
Error	20	1.068	2.165	0.749

Appendix V. Effect of thinning time and variety and their interaction on no. of branch of sesame plant at different days after sowing

No. of Branch				
Source of Variation	**Degrees of Freedom**	**Mean Square Value**		
		40 DAS	**50 DAS**	**60 DAS**
Replication	2	0.001	0.088	0.209
Variety (V)	1	7.023*	5.290*	6.208*
Error	2	0.038	0.188	0.218
Thinning Time (T)	5	1.468*	2.147*	3.779*
VxT	5	0.020*	0.036*	0.149*
Error	20	0.046	0.122	0.138

Appendix VI. Effect of thinning time and variety and their interaction on no. of capsules at different branches of sesame plant

No. of capsule of Different Branches					
Source of Variation	**Degrees of Freedom**	**Mean Square Value**			
		1st Branch	**2nd Branch**	**3rd Branch**	**Other Parts**
Replication	2	0.708	0.480	0.112	0.694
Variety (V)	1	39.490*	12.602*	34.987*	225*
Error	2	0.474	0.576	0.374	1.583
Thinning Time (T)	5	13.107*	6.812*	17.026*	159.844*
VxT	5	4.427*	0.214*	0.501*	6.40*
Error	20	0.180	0.301	0.184	1.672

Appendix VII. Effect of thinning time and variety and their interaction on yield parameter of sesame at harvest

Source of Variation	Degrees of Freedom	Total Capsule per plant	Mean Square Value				
			1000 seed weight	Seed Yield	Stover Yield	Biological yield	Harvest Index
Replication	2	4.545	0.012	2660.075	4013.194	10894.670	0.273
Variety (V)	1	945.460*	1.030*	143576.576*	514806.250*	1202126.116*	31.118*
Error	2	5.485	0.034	4606.778	25411.083	42738.282	0.783
Thinning Time (T)	5	525.188*	0.547*	44567.602*	1034235.761*	1490507.632*	7.310*
VxT	5	19.373*	0.052*	3252.402*	9480.383*	9250.726*	2.888*
Error	20	3.529	0.012	1434.424	30755.406	34597.424	1.601