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ON-FARM VERIFICATION OF LINSEED AND SESAME VARIETY FOR FALLOW-FALLOW-T AMAN RICE CROPPING SYSTEM IN SYLHET REGION OF BANGLADESH

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Abstract

A field experiment was conducted during rabi and kharif seasons of 2014-15 and 2015-16 to find out suitable linseed and sesame genotypes to fit in the Fallow-Fallow-T. aman rice cropping system under AEZ 20 in Sylhet region of Bangladesh. This experiment was laid out in a randomized complete block design (RCBD) with six dispersed replications. It was revealed that among the different linseed varieties, the genotype Zokiganj-local gave the maximum number (31.40) of capsules plant^{-1} and 1000-seed weight (4.01g) with the highest seed yield (1003 kg ha^{-1}). Similarly, sesame var. BARI Til-4 provided maximum number of capsules plant^{-1} (71.33), seeds plant^{-1} (70.33) and highest 1000-seed weight (3.012g), which resulted the highest seed yield (1150 kg ha^{-1}) yield in arable fallow land of Sylhet region. The lowest seed yield 782 and 840 kg ha^{-1} of linseed and sesame was produced by the genotypes Patuakhali local and the var. BARI Til-3, respectively.

Introduction

Sylhet region of Eastern Bangladesh is dominated by drought prone rice based rainfed ecosystem as about 182000 ha of arable land remainse fallow during kharif 1 season. Sesame *(Sesamum indicum* L.) is one of the most ancient oilseed crops (Ashri, 1998; Bedigan and Harlan, 1986) of the world. It is the second largest source of edible oil in Bangladesh next to *Brassica* both in respect of acreage and production (Anonymous, 1989) and can be cultivated both in rabi (winter) and kharif (summer) season. It occupied 38866 ha of land and produced 25000 tons of seed with a yield of 640 kg ha^{-1} (BBS, 2004). Sesame seeds have special significance for human nutrition on account of its high content of sulfur amino acids and phytosterols (Pathak *et al.,* 2014).

Sesame oil-cake is a good feed for poultry, fish, cattle, goat, sheep etc. Sesame is a drought tolerant oil seed crop, which are grown successfully in the early summer (March-May) of Bangladesh under rain fed condition. Linseed (*Linum usitatissimum* L.) is an annual herb belonging to the family Linaceae, which is commonly found in Asia (Fernald, 1950). Linseed is basically known as a crop of industrial importance and used in paint and varnish industries, which contains 33-43 % oil of drying type and 24 % protein (Vereshagin *et. al.*, 1965). Its oil has high percentages of unsaturated fatty acids and 17 % linoleic acid (McHughen, 1990). It is also used for making linoleum, oil cloth, printer's ink, soap and patent leather. Linseed can play an important role in the production of alternative diesel fuel (Nabi and Hoque 2008; Ariharan *et al,* 2015). The climatic and soil condition of Bangladesh is suitable for the production of linseed crop. Nematallahi and Saeidi (2011) found significant differences in the response of several linseed genotypes to drought, with some being drought tolerant and others being drought sensitive. In Sylhet region, 164000 ha of land remain fallow during dry winter season because of varying degrees of existing soil moisture. As both sesame and linseed are considered as drought tolerant oil seed crops, they are presumed to be cultivated economically in the drought prone areas of Bangladesh. Therefore, the present investigation was carried out to assess the performance of linseed and sesame varieties under rainfed conditions for Sylhet area.

Materials and Methods

The experiment was conducted at multi location testing (MLT) site, Zokiganj during rabi and kharif-I seasons of 2014-15 and 2015-16 to select suitable linseed and sesame genotypes to fit into the Fallow-Fallow-T. (Transplanted) aman rice cropping system under AEZ 20 in Sylhet region of Bangladesh. This is located in between 24^0 51' and 25^0 00' north latitudes and $92^0$13' and 92^0 30' east longitudes and on an altitude of 10 meters. Total cultivable land in the area is 11210 ha, which covered 70% single cropped, 63% double cropped and 88% triple cropped with cropping intensity 169%. The area is dominated by medium land with clay loam and loamy soils. Major crops are paddy, mustard, sesame, linseed, potato, and winter vegetables. The dominant cropping patterns are fallow-fallow-T. aman rice, fallow-T. aus rice-T. aman rice, vegetable-T. aus rice-T. aman rice and Boro rice-fallow-fallow. The monthly temperature and rainfall for the experimental site are indicated in Figures 1 and 2. The average climatic data of Sylhet shows that the mean annual minimum temperature was 16.20 ^{0}C and the mean annual maximum temperature was 33.7 ^{0}C and the annual mean temperature was nearly 17.15 ^{0}C.

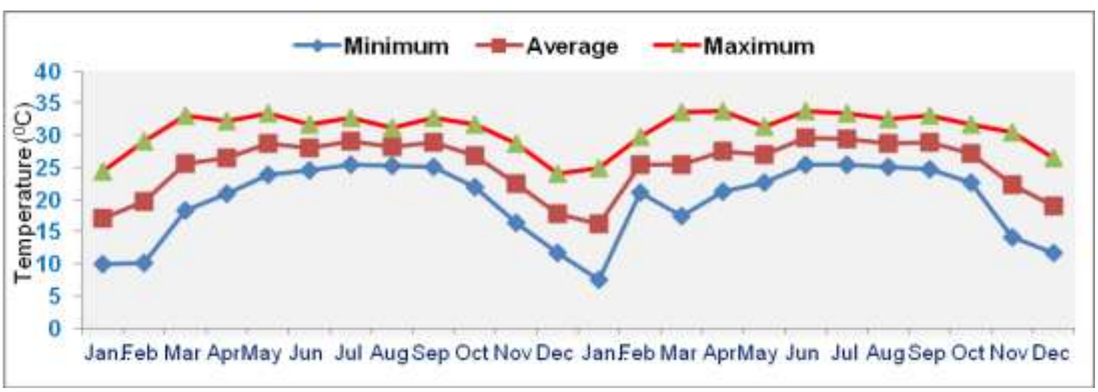

Fig. 1. Minimum, maximum and mean temperature (^{0}C) pattern in Sylhet of Bangladesh

As indicated in Figure 2, rainfall of the area is uni-modal, usually occurring during April to October, and total annual rainfall reached to 3372 mm; whereas in December no rain at all and lowest amount of rainfall occurs in January followed by February. However, in rest of the months total rainfall was ranged from 112 mm to just below 200 mm. Rainfall increases gradually from the month of May and continued up to September.

This experiment was laid out in a randomized complete block design (RCBD) with six dispersed replications. There were four different genotypes of linseed (var. BARI Tishi-1: Nila, Noakhali-Local, Patuakhali-Local and Zakiganj-Local) and sesame (T-6, BARI Til-2, BARI Til-3 and BARI Til-4) with seed rate 8.0 and 7.5 kg ha^{-1}, respectively. The unit plot size was 10 m × 10 m. Seeds were sown in broadcast method.

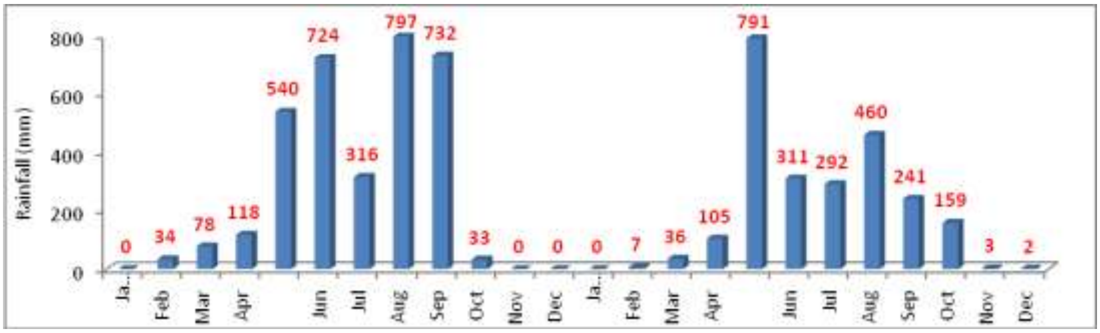

Fig. 2. Annual rainfall (mm) pattern in Sylhet of Bangladesh

The seeds of linseed varieties were sown on 5-7 December and harvested on 10-15 March; on the contrary, sesame seeds were sown on 15-18 March and the crop harvested at full maturity on 12-15 June in 2014-15 and 2015-16, respectively. The seed yield was adjusted to 8% moisture content. The fertilizer nutrients NPKS (38-13-20-8 for linseed and 56-23-40-18 kg ha^{-1} for sesame) were applied in the form of urea, triple superphosphate (TSP), muriate of potash (MoP) and gypsum, respectively (FRG, 2012). All fertilizers were applied as a basal during final land preparation. Plant protection measures and different intercultural operations were taken as and when necessary to raise healthy crops. The recorded data were statistically analyzed and mean values were separated by LSD test following Gomez and Gomez (1984).

Results and Discussion

Crop calendar in study area

The following seasonal activities were done during conducting the trial at farmers field (Fig. 3). Generally, aus rice transplanting was started in March and subsequent aman rice during the mid June to mid July and harvested within 2nd week of November. But in Sylhet area, transplantation of aus rice being depended on rainfall and was done in early May. This delayed transplantation of aus rice, ultimately hampered the timely cultivation of subsequent T. aman rice and resulting delay sowing of rabi crops. To overcome this situation farmers cultivate local cultivars with less care and crop management practices.

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<tr><td colspan="4">Rabi</td><td colspan="8">Kharif-1</td><td colspan="8">Kharif-2</td><td colspan="4">Rabi</td></tr>
<tr><td colspan="5">Fallow</td><td colspan="8">Fallow</td><td colspan="9">T. aman rice</td><td colspan="2"></td></tr>
<tr><td colspan="5">Linseed</td><td colspan="8">Sesame</td><td colspan="8">T. aman rice</td><td colspan="3">Linseed</td></tr>
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Fig. 3. Seasonal activity calendar showing two crops in cropping pattern of study area

Crop: Linseed

It was revealed from the experimental results that among the different linseed varieties, the number of plant m^{-2} was non-significant; however, numerically the maximum number of plant m^{-2} was observed in BARI Tisi-1(Nila) followed by genotype Patuakhali-local. Plant height was significantly influenced where the highest plant height was found in var. BARI Tishi-1 (64.85 cm) while the shortest (52.73 cm) in genotype Noakhali-local. Number of capsules in each individual is an important yield contributing characters of linseed crop. The maximum number of capsules plant^{-1} was recorded in linseed genotype Zakiganj-local (31.40) that was statistically followed by var. BARI Tisi-1 (21.28); while minimum number in Patuakhali-local (19.13). The number of seeds capsule^{-1} was non-significant. Among tested genotypes, Zakiganj-local produced maximum 1000-seed weight (4.01 g) followed by Noakhali-local (3.66 g) and the lowest in var. BARI Tishi-1 (3.57 g). Zaj c (2005) reported that the productivity of linseed crop largely depends on its morphological characters associated with foliage. The maximum seed yield (1003 kg ha^{-1}) was recorded in Zakiganj-local that was statistically identical with Noakhali-local (820 kg ha^{-1}). However, the lowest seed yield (782 kg ha^{-1}) was found in Patuakhali-local.

Table 1. Seed yield and yield attributes of linseed varieties under on-farm trial during the rabi season of 2014-16; (pooled)

Variety	Plants m^{-2} (cm)	Plant height (cm)	Capsules plant^{-1} (no.)	Seeds capsule^{-1} (no.)	1000-seed weight (g)	Seed yield (kg ha^{-1})
BARI Tishi-1	221	64.85	21.28	7.22	3.57	790
Noakhali-local	191	49.55	20.63	7.37	3.66	820
Patuakhali-local	207	52.73	19.13	7.53	3.64	782
Zakiganj-local	201	50.80	31.40	7.73	4.01	1003
CV (%)	8.21	3.69	20.55	7.53	4.74	11.41
LSD $_{(0.05)}$	NS	4.17	9.6	NS	0.6	193.50

Crop: Sesame

The result showed that plant height, capsules plant^{-1}, seeds capsule^{-1}, 1000-seed weight and seed yield were significantly influenced by different genotypes of sesame except plants m^{-2}. It was noted from the experimental results that among the different sesame genotypes, the maximum plant height (101.10 cm) was found in the var. BARI Til-4 followed by BARI Til-2 (99.89 cm) and T-6 (99.83 cm). But, the var. BARI Til-4 produced the maximum number of capsules plant^{-1} (71.33) which was statistically similar to var. BARI Til-2 (68.67) and T-6, while var. BARI Til-3 produced the lowest number of capsules plant^{-1} (50.33). These results are in agreement with findings of Tiwari *et al.* (2000) and Kathiresan (2002). They reported that the number of capsules plant^{-1} varied significantly in different cultivars.

Number of seeds capsule^{1} was significantly influenced by varieties The var. BARI Til-4 produced the highest number of seeds capsule^{-1}(70.33) followed by BARI Til-2 whereas var. BARI Til-3 produced the lowest number of seeds capsule^{-1} (53.00). These findings corroborated with the findings of Nandita *et al.* (2009) and Kathiresan (2002). Variable effect of varieties on seeds capsule^{-1} in sesame plant was also reported by Begum *et al.* It is stated that among the different sesame varieties, BARI Til-4 yielded maximum 1000-seed weight (3.12 g) followed by BARI Til-2 and T-6 where as var. BARI Til-3 produced lowest 1000-seed weight (2.81 g). The seed yield of sesame are generally resulted the cumulative effect of capsules plant^{-1}, seeds capsule^{-1} and 1000-seed weight (Rahman *et al.*, 1995). It was observed that there was significant difference in seed yield plant^{-1} among the varieties. The var. BARI Til-4 produced the maximum seed yield plant^{-1} (1150 kg ha^{-1}) followed by BARI Til-2 (1142 kg ha^{-1}) while var. BARI Til-3 gave the lowest seed yield (840 kg ha^{-1}). These results were supported by other researcher (Khan et al., 2009).

Table 2. Seed yield and yield attributes of sesame varieties under on-farm trial during the kharif season of 2014-16 (pooled).

Variety	Plants m^{-2} (no.)	Plant height (cm)	Capsules $plant^{-1}$ (no.)	Seeds $capsule^{-1}$ (no.)	1000-seed weight (g)	Seed yield (kg ha^{-1})
T-6	41.23	99.83	65.33	61.33	2.86	980
BARI Til-2	37.23	99.89	68.67	67.33	2.94	1142
BARI Til-3	44.57	95.76	50.33	53.00	2.81	840
BARI Til-4	40.57	101.10	71.33	70.33	3.12	1150
CV (%)	9.61	1.25	8.33	8.92	7.58	7.02
$LSD_{(0.05)}$	NS	2.57	10.21	11.69	0.44	144.00

Conclusion

The result showed that sesame var. BARI Til-4 produced higher seed yield followed by BARI Til-2 but in case of linseed var. Zokiganj-local out-yielded the other local as well as BARI developed linseed var. BARI Tishi-1. So, local variety of linseed should be given priority and yield could be enhanced by proper cultivation program.

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