Studies on phenology and partitioning of biomass in taramira (*Eruca sativa*)

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Abstract

The experiment was conducted during the winter seasons of 2000-01 and 2001-02 at CCS HAU, Regional Research Station, Bawal to assess the comparative performance of various taramira genotypes, namely, TC-15, TC-22, TC-31, DITA-1, BTM-1, BTM-2 and two checks T-27 and RTM-314 in terms of phenological parameters, partitioning of biomass traits, seed yield and its attributes under rainfed situation. At initial stage, up to 50 days of sowing, maximum dry matter was accumulated in leaf (> 75%), followed by root (7.84 to 14.6%) and stem (4.8 to 12.6%). At physiological maturity, DITA-1(133g) accumulated maximum total biomass followed by TC-31(124 g) and TC-15(122g). Number of days taken for 50 per cent flowering was less in T-27 and BTM-1 (56 days each) and more in BTM-2 (62 days). Genotypes TC-15, TC-22, TC-31 and DITA-1 took more number of days for maturity than check T-27(155 days). The genotype DITA-1 was statistically at par with TC-15 and TC-31 but out yielded both the checks RTM-314 and T-27 by a margin of 24.6 and 45.6 per cent respectively owing to its more number of siliquae per plant, siliquae on main shoot, 1000-seed weight and comparable number of seeds per siliqua. Harvest index (%) was significantly higher in TC-31(24.9) and DITA-1 (24.7) than check RTM-314 (20.7).

Key words: *Eruca sativa*, biomass partitioning, phenology, seed yield, taramira

Introduction

Taramira is generally cultivated under various situations in marginal lands where rainfall is very limited or sowing is delayed or cultivation of other crops is not possible. Improvement in grain yield of cereals has been achieved through increase in harvest index between tall and dwarf varieties (Loss et al; 1989). A similar increase in productivity of taramira could be achieved by greater allocation of assimilates from vegetative plant parts to seeds in pods. The change in the partitioning of biomass from vegetative plant parts to seed could be altered through modification in architecture by choosing cultivars of varied genetic background efficient in translocation of these assimilates. Understanding of phenological causes of reduction in seed yield will help in developing strategies for improving the seed yield through this approach. The partitioning of biomass in various plant parts is controlled by phenological phases of a plant. The present study was therefore, undertaken to assess the comparative performance of phenological and partitioning parameters among different taramira genotypes.

Material and methods

The experiment was conducted during *rabi* seasons of 2000-01 and 2001-02 at CCS Haryana Agricultural University, Regional Research Station, Bawal. The experiment was laid out in randomized block design with three replications. The treatments comprised of six newly developed taramira genotypes viz. TC-15, TC-22, TC-31, DITA-1, BTM-1 and BTM-2 and two national checks viz. T-27 and RTM-314. The soil type was loamy sand, low in organic carbon (0.20%) and alkaline in reaction (pH=8.2). The experiment was sown as rainfed at a row spacing of 45 cm with plant-to-plant distance of 15 cm. The crop was uniformly fertilized with 30 kg N/ha at sowing time. The experiment was sown on Oct.16 and Oct.18 in the respective seasons. The total rainfall received during the crop seasons was 32.7 and 27.0 mm respectively.

Five plants were randomly selected in each treatment and averaged for recording the changes in dry weight in leaves, stem and reproductive parts (siliqua) separately at 3 stages of growth, 50, 100 and 150 days after sowing. These samples were first dried under the sun and thereafter in the oven at 70 ^{o} C till a constant weight were recorded. Phenological stages were taken into consideration as suggested by Sylvester and Hakepeace (1984).

Results and discussion

Partitioning of biomass: The data were analysed separately for both the years and year x genotype interaction was found non- significant. Hence, the data were pooled for both the years. The increase in total biomass during initial vegetative growth stage (50 DAS) was low (Table 1) but it increased from 50 DAS to 100 DAS and at a slower rate thereafter till maturity. However, different components (root, leaf, stem and siliqua) did not follow the same trend. The major amount of biomass up to 50 DAS was contributed by leaf (>75%) and differences in stem and root were minimum. Thereafter, though the growth of leaf and stem continued but the rate of biomass accumulations in stem surpassed (37.48 to 44.26 %) that of leaf and roots. At physiological maturity, genotype DITA-1 had accumulated maximum total biomass, followed by TC-31 and TC-15. The contribution of stem at harvest was 25.26 to 31.60 % and that of siliqua was 62.51 to 67.24% in pooled data of two years. The marked differences of dry matter accumulation among different plant parts within *Brassicas* had also been reported by Mehrotra *et. al.* (1980).

Table- 1: Partitioning of dry matter plant parts of taramira genotypes (Mean of 2000-01 and 2001-02).

Genotypes	50DAS				100DAS					150DAS				
	Root	Stem	Leaf	Total(g)	Root	Stem	Leaf	Reprod part	Total(g)	Root	Stem	Leaf	Reprod part	Total(g)
TC-15	0.83 (12.5)	0.45 (6.77)	5.35 (80.57)	6.64	4.76 (6.25)	32.49 (42.61)	19.46 (25.58)	19.43 (25.53)	76.08	5.50 (4.49)	34.05 (27.82)	3.40 (2.78)	79.40 (64.89)	122.35
TC-22	0.70 (9.97)	0.65 (9.25)	5.67 (80.76)	7.02	4.70 (6.81)	29.27 (42.42)	18.85 (27.32)	16.18 (23.44)	69.00	4.50 (3.49)	37.85 (29.37)	2.50 (1.94)	84.02 (65.19)	128.87
TC-31	0.69 (10.66)	0.82 (12.67)	4.95 (76.50)	6.47	5.42 (6.97)	31.53 (40.55)	23.47 (30.19)	17.32 (22.28)	77.74	4.15 (3.33)	39.10 (31.42)	3.40 (2.73)	77.79 (62.51)	124.44
DITA-I	0.76 (10.39)	0.91 (12.44)	5.64 (77.15)	7.31	5.09 (6.34)	31.40 (39.14)	21.90 (27.29)	21.84 (27.22)	80.23	5.65 (4.25)	33.60 (25.26)	4.20 (3.16)	89.53 (67.32)	132.98
RTM-314(C)	0.58 (7.88)	0.46 (6.25)	6.32 (85.86)	7.36	4.69 (6.57)	26.75 (37.48)	21.28 (29.81)	18.66 (26.14)	71.38	6.25 (5.01)	33.90 (27.19)	2.40 (1.93)	82.11 (65.86)	124.66
BTM-1	0.84 (14.60)	0.28 (4.87)	4.63 (80.52)	5.75	4.50 (6.68)	26.86 (39.87)	19.72 (29.27)	16.29 (24.17)	67.37	5.15 (4.31)	31.60 (26.43)	2.40 (2.01)	80.37 (67.24)	119.52
BTM-2	0.36 (8.35)	0.34 (7.88)	3.61 (83.75)	4.31	5.12 (7.08)	30.37 (41.98)	19.86 (27.45)	16.98 (23.22)	72.33	4.20 (3.71)	35.10 (31.02)	2.70 (2.39)	71.13 (62.87)	113.13
T-27 (C)	0.70 (10.80)	0.46 (7.10)	5.32 (82.09)	6.48	5.50 (8.01)	30.40 (44.26)	15.08 (21.95)	17.77 (25.77)	68.68	4.05 (3.56)	31.50 (27.74)	1.80 (1.59)	76.20 (67.10)	113.55

Note: Values in parenthesis denote the percentage

Table- 2: Phenological, morphological, seed yield and its attributes in taramira genotypes (Mean of 2000-01 and 2001-02).

Genotypes	Days to 50% flowering	Siliqua & Seed Dev. (days)	Maturity (days)	Plant ht. (cm)	Prim. Branches	Sec. Branches	Siliquae on main shoot	Siliqua per plant	Seeds per siliqua	1000-seed (wt. g)	Harvest index (%)	Seed yield (Kg/ha) 00-01	Seed yield (Kg/ha) 01-02	Mean yield (kg/ha)
TC-15	58	134	159	137	8	29	25	700	18.3	3.53	23.1	1695	1460	1578
TC-22	60	132	159	135	10	27	21	631	18.1	3.23	21.2	1318	1340	1324
TC-31	58	132	159	145	7	21	26	794	19.2	3.36	24.9	1710	1410	1560
DITA-1	59	132	159	138	9	23	25	848	19.3	3.61	24.7	1998	1510	1754
RTM-314(C)	58	132	158	130	10	28	22	615	18.8	3.49	20.4	1646	1170	1408
BTM-1	56	128	155	134	10	27	23	577	19.5	3.78	23.4	1244	1260	1252
BTM-2	62	128	155	138	8	23	22	560	20.1	3.53	23.7	1505	1280	1393
T-27(C)	56	130	155	138	8	24	22	467	17.8	3.46	24.8	1149	1270	1209
C.D 5%	3.08	2.82	2.24	9.0	2.0	3.0	3.0	82	1.2	0.23	2.6	224	200	204

Dev. = Development, ht. = hight, Prim. = Primary, Sec. = Secondary, wt. = weight

Phenological studies: Phenological phases of a plant have a greater role towards partitioning of biomass in various plant parts. Therefore, understanding of phenological causes of determining seed yield will help in developing strategies for improving the seed yield. In table 2, genotype T-27 and BTM-1 were earliest and BTM-2 took significantly maximum number of days to 50% flowering (62 days). Siliqua and seed development was completed early (128 days) in BTM-1 and BTM-2 genotypes. Number of days taken for maturity were equal (159 days) among TC-15, TC-22, TC-31 and DITA-1 genotypes whereas BTM-1, BTM-2 and T-27 were early (155 days). There were significant variations in plant height among different genotypes of taramira. The plant height of TC-31 was significantly higher than RTM-314, TC-22 and BTM-1. The genotype TC-22 and BTM-1 had similar number of primary branches but significantly better than T-27. Number of secondary branches in TC-15 was significantly higher than T-27, BTM-2, TC-31 and DITA-1.

Morphological parameters, seed yield and its attributes: On mean basis, DITA-1 was statistical at par with TC-15 and TC-31 but produced significantly higher seed yield than all other genotypes owing to its more number of siliqua on main shoot, siliquae per plant, 1000-seed weight and comparable seeds per siliqua (Table 2). The genotype DITA –1 out yielded both the checks RTM-314 and T-27 by a margin of 24.6 and 45.6 per cent, respectively. However, TC-15 and TC-31 could out yield T-27 only. The genotypes TC-22, BTM-1 and BTM-2 were statistically at par with both the checks for seed yield. Harvest index was significantly higher in TC-31 and DITA-1 genotypes against the check RTM-314 because of its lower stover yield in proportion to seed yield. The significant variations in harvest indices were due to differences in their partitioning of biomass, morphology and duration of crop maturity. Kumar *et al.* (2001) reported wide variations in harvest indices in *Brassicas*.

Based on the results of this study it is found that the genotype DITA-1 which produced significantly higher seed yield than all other genotypes owing to its more number of siliquae on main shoot, siliquae/plant, 1000-seed weight and better partitioning of biomass can be further verified and confirmed before it is finally released for cultivation.

Acknowledgement

The financial support provided by ICAR through NATP to carry out this research is duly acknowledged.

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