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RESEARCH ARTICLE

EFFECT OF IRRIGATIONS AND MANAGEMENT PRACTICES ON GROWTH AND YIELD OF RAPE SEED AND MUSTARD CROPS IN SOUTH KAMRUP AREA OF ASSAM

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ABSTRACT

A field trial was undertaken during the crop year 2023–24 at Malibari in Kamrup district, Assam, to evaluate the combined effects of irrigation practices and varietal performance on rapeseed and mustard cultivation under farmer-managed conditions. The study included three irrigation schedules and four crop varieties: PM-28, TS-38, TS-36, and M-27. Among the varieties tested, PM-28 produced the highest seed yield, followed by TS-38, TS-36, and M-27. However, it was noted that PM-28 exhibited comparatively lower oil content, especially when compared to TS-38 and TS-36, highlighting a potential trade-off between seed yield and oil quality. In terms of irrigation, the treatment involving two irrigations at 4 cm depth—one at the pre-sowing stage and the other at the pre-flowering stage—consistently resulted in the highest seed yields across all varieties. This irrigation schedule proved to be the most effective under the agro-climatic conditions of Malibari, emphasizing the importance of timely water application. Additionally, farmers from Alubari village showed strong participation and achieved satisfactory crop performance, validating the practical applicability of the trial findings. Their success demonstrated the benefits of integrating appropriate irrigation management with improved varietal selection, especially in the context of Assam's largely rainfed agricultural system.

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INTRODUCTION

In Assam, rapeseed and mustard are traditionally cultivated as rainfed crops, relying primarily on residual soil moisture during the winter (rabi) season. However, research and field experience have demonstrated that these crops respond positively to well-scheduled irrigation, showing significant improvements in yield and quality under managed water application. Despite its favorable agro-climatic conditions, Assam contributes only 2.05% to India's total oilseed production, a figure that highlights the state's relatively low output compared to other regions. Currently, the total area under rapeseed and mustard cultivation in Assam stands at 2.89 lakh hectares, with an average productivity of 647 kg/ha. This level of production is insufficient to meet the state's growing demand for edible oil.To achieve self-sufficiency in edible oil production from rapeseed and mustard, it is estimated that Assam would need to expand the cultivation area to 8.8 lakh hectares and improve productivity to at least 1.0 tonne per hectare under rainfed conditions. However, a major constraint is the lack of adequate irrigation infrastructure, especially during the winter season when these crops are grown. Given these challenges, the present study was undertaken to explore the effect of irrigation scheduling, combined with fertilizer management, on the yield performance of rapeseed and mustard. The objective is to identify feasible agronomic practices that can enhance oilseed productivity under both rainfed and limited irrigation conditions, thereby contributing to the goal of increased oilseed production in Assam.

MATERIALS AND METHODS

A field trial was carried out during the 2023–24 rabi season under farmer's field conditions in the Malibari area of South Kamrup, located in Kamrup district of Assam. The objective was to assess the effect of irrigation scheduling on the performance of different rapeseed and mustard varieties. Four varieties—PM-28, TS-38, TS-36, and M-27—were selected for the trial. Irrigation was scheduled at two critical crop growth stages: pre-sowing and pre-flowering, with each irrigation applied at a depth of 4 cm. A total of four farmers participated in this experiment, and uniform management practices were maintained across all plots, including the same sowing date, fertilizer dose, and input application. Sowing was done on 15th November 2023, and the crop was harvested on 16th February 2024. Farmyard manure (FYM) was applied at the rate of 4–5 tonnes per hectare, and a fertilizer dose of 40:35:10 kg/ha of N, P_2O_5, and K_2O was uniformly applied just before sowing during the final land preparation. The trial was laid out in a factorial randomized block design (RBD) with four replications. The maximum and minimum temperatures recorded during the crop period ranged from 28°C to 18°C, respectively, while the total rainfall received was between 60–80 mm. Soil analysis of the experimental site indicated a sandy loam to loamy texture with a slightly acidic pH of 5.2. The soil was medium in available nitrogen, low to medium in available phosphorus, and high in potassium content. The organic matter content was recorded at 0.49% during the crop period. In addition to the main trial, a demonstration trial was conducted in 2024–25 involving 50 farmers across five villages: Alubari, 2 No. Bamonbari, Alubari Bazar, Puran Malibari, and Malibari. Each farmer was allotted an area of three bighas, and the variety TS-38 was grown by all participating farmers. Inputs such as seeds and fertilizers were provided in a timely and uniform manner. Yield data were collected from both experimental and demonstration plots for comparative analysis. Parameters recorded during the study included seed yield (q/ha), oil content (%), dry matter yield (g/plant), siliqua per plant, consumptive water use (mm), and water use efficiency (WUE, kg/ha-mm). The yield data of the 50 farmers participating in the demonstration trial were also compiled and presented separately (Table-2).

RESULTS AND DISCUSSION

The results of the field trial revealed that the irrigation treatment I_2 (irrigation at both pre-sowing and pre-flowering stages @ 4 cm depth) recorded the highest dry matter yield, which was significantly superior to the other irrigation treatments. This positive trend was also observed in key yield components such as siliqua per plant and seed yield (kg/ha). Moreover, consumptive water use, water use efficiency (WUE), and oil content (%) were also found to be highest under I_2, indicating the effectiveness of timely irrigation in enhancing overall crop performance. Among the varieties tested, PM-28 recorded the highest dry matter yield (g/plant) and was significantly superior to the other varieties (Table 1). The lowest seed yield was observed in the variety M-27, which was statistically at par with TS-36 but significantly inferior to the other treatments. Similarly, PM-28 showed higher consumptive water use and WUE, followed

Table 1. Effect of Irrigation scheduling on Growth and Yield attributes of Rapeseed Mustard

Treatments Irrigation Schedules	Dry Matter Yield (g/plant)	Oil content (%)	Consumptive use (mm)	Siliqua/plant	WUE (kg/ha-mm)	Seed Yield (kg/ha)
I_o (Rainfall)	109.6	37.5	154.00	49.00	6.82	1050
I_1 (4 cm Irrigation Before sowing)	125.0	39.85	186.00	68.15	6.56	1220
I_2 (4cm Irrigation at Pre-Flowering stage + I_1)	149.5	41.15	215.15	80.50	7.43	1600
CD at 5%	7.0	NS	-	24.0	-	42.0
Varieties						
M-27	110.15	37.05	148.00	50.00	6.05	0895
TS-36	116.45	38.65	169.00	56.50	6.02	1018
TS -38	132.00	40.80	175.00	68.15	6.57	1150
PM – 28	146.00	39.00	186.50	88.05	9.65	1800
CD at 5%	4.5	NS	-	36.0	-	53.0

Table 2: List of selected farmers of Malibari area, Kamrup (Assam) for growing Rape seed (Var. TS-38) during 2024-25.

Sl.No	Farmers	Villages	Seeds (kg)	Area (Bigha)	N-P-k Fertilizer (kg)	Yield (q/Bigha)
1	F_1 (SD)	ALUBARI	3.30	3.0	40-35-10	1.65
2	F_2 (DD)	ALUBARI	3.30	3.0	40-35-10	2.15
3	F_3 (SD)	ALUBARI	3.30	3.0	40-35-10	1.80
4	F_4 (RD)	ALUBARI	3.30	3.0	40-35-10	2.25
5	F_5 (HD)	ALUBARI	3.30	3.0	40-35-10	1.76
6	F_6 (BD)	ALUBARI	3.30	3.0	40-35-10	1.34
7	F_7 (PD)	ALUBARI	3.30	3.0	40-35-10	1.37
8	F_8 (UD)	ALUBARI	3.30	3.0	40-35-10	1.68
9	F_9 (JD)	ALUBARI	3.30	3.0	40-35-10	1.57
10	F_{10} (KD)	ALUBARI	3.30	3.0	40-35-10	1.63
11	F_{11} (PD)	PURAN MALIBARI	3.15	3.0	40-35-10	1.38
12	F_{12} (SD)	PURAN MALIBARI	3.15	3.0	40-35-10	1.40
13	F_{13} (PD)	PURAN MALIBARI	3.15	3.0	40-35-10	1.68
14	F_{14} (ND)	PURAN MALIBARI	3.15	3.0	40-35-10	1.39
15	F_{15}(AD)	PURAN MALIBARI	3.15	3.0	40-35-10	1.44
16	F_{16}(GD)	PURAN MALIBARI	3.15	3.0	40-35-10	1.77
17	F_{17}(SD)	PURAN MALIBARI	3.15	3.0	40-35-10	1.61
18	F_{18}(JD)	PURAN MALIBARI	3.15	3.0	40-35-10	1.78
19	F_{19}(AD)	PURAN MALIBARI	3.15	3.0	40-35-10	1.55
20	F_{20} (KD)	PURAN MALIBARI	3.15	3.0	40-35-10	1.79
21	F_{21} (4D)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.70
22	F_{22} (KD)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.79
23	F_{23} (SD)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.74
24	F_{24} (BD)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.72
25	F_{25} (PD)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.80
26	F_{26} (AD)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.82
27	F_{27} (HD)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.77
28	F_{28} (JD)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.69
29	F_{29} (ND)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.85
30	F_{30} (KD)	2 NO BAMUN BARI	3.10	3.0	40-35-10	1.75
31	F_{31} (GD)	MALIBARI	3.20	3.0	40-35-10	1.69
32	F_{32} (BD)	MALIBARI	3.20	3.0	40-35-10	1.65
33	F_{33} (MD)	MALIBARI	3.20	3.0	40-35-10	1.82
34	F_{34} (CD)	MALIBARI	3.20	3.0	40-35-10	1.72
35	F_{35} (AD)	MALIBARI	3.20	3.0	40-35-10	1.58
36	F_{36} (RD)	MALIBARI	3.20	3.0	40-35-10	1.55
37	F_{37} (LD)	MALIBARI	3.20	3.0	40-35-10	1.72
38	F_{138} (ND)	MALIBARI	3.20	3.0	40-35-10	1.77
39	F_{39} (SD)	MALIBARI	3.20	3.0	40-35-10	1.72
40	F_{40} (AD)	MALIBARI	3.20	3.0	40-35-10	1.80
41	F_{41} (AH)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.39
42	F_{42} (JH)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.50
43	F_{43} (M1)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.44
44	F_{44} (SI)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.45
45	F_{45} (BI)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.38
46	F_{46} (SA)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.49
47	F_{47} (BA)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.58
48	F_{48} (FA)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.44
49	F_{49} (BI)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.50
50	F_{50} (AA)	ALUBARI BAZAR	3.0	3.0	40-35-10	1.55

by TS-38, TS-36, and M-27. The highest seed yield was also obtained from PM-28, which was significantly superior to the rest of the varieties, while M-27 continued to perform poorly in terms of yield. The increased seed yield due to irrigation was primarily attributed to its beneficial effect on siliqua formation. A greater number of siliqua per plant was recorded when 4 cm depth of irrigation was applied at the pre-flowering stage, confirming the critical importance of water availability during reproductive growth. Differences in consumptive use of water among varieties may also be due to variation in crop duration, even when sown under the same field conditions.In the demonstration trial involving 50 farmers, the highest yield was recorded by farmers in Alubari village, followed by those from 2 No. Bamonbari, Malibari, and Alubari Bazar. This variation can be attributed to the optimum use of seed and fertilizer rates, timely sowing, and proper thinning practices adopted by the Alubari farmers. In contrast, the lowest yield (q/bigha) was recorded in Alubari Bazar, where poor land preparation and lack of pre-sowing irrigation were observed, contributing to the yield decline. Overall, the results highlight that water is the most limiting factor for crop production in the rainfed areas of Assam. Therefore, proper irrigation scheduling, particularly based on critical crop growth stages, can significantly enhance water productivity and seed yield. This crop-stage-based water management approach is essential for improving the yield potential of rapeseed and mustard in the region, especially under stressed and rain-dependent environments.

CONCLUSIONS

The current study concludes that the irrigation scheduling with two irrigations *viz* Pre-sowing irrigation and at Pre- flowering stage @4cm depth has improved the crop growth and yield characters of Rape seed and Mustard in South Kamrup area of Assam. Yield and Yield attributes, water productivity and Fertilizer use efficiency will definitely be higher in case of varieties like PM-28,TS-38 and TS-36 if irrigations are applied together with optimum dose of fertilizers in future.

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