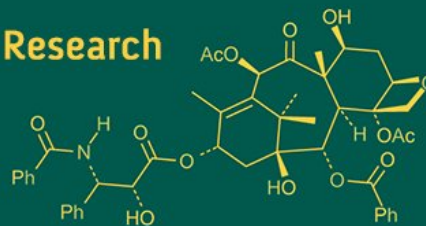


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Effect of organic weed management practices on growth attributes of maize (*Zea mays* L.)

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Abstract

The current study, "Effect of organic weed management practices on productivity of maize (*Zea mays* L.)," was carried out in the Kharif season of 2025-2026 at the Agriculture Research Farm, Faculty of Agriculture Science, Mandsaur University, Mandsaur (M.P.). The goal of the study was to assess how different organic weed control techniques affected standard maize growth features. T₁: Control; T₂: Weed-free manual; T₃: Hand weeding at 15 DAS; T₄: Plastic mulch; T₅: Straw mulch following germination; T₆: One hoeing at 15 DAS followed by hand weeding at 30 DAS; T₇: Hand weeding at 25 DAS followed by intercultural operation at 45 DAS; and T₈: Application of organic herbicide. A Randomized Block Design (RBD) with eight treatments and three replications was used to sow the maize variety Kaveri Super 2020 in a total of twenty-four plots. The gross plot area was 20 m², while the net plot size was 12 m². Plants were spaced 45 cm x 30 cm apart. A seed rate of 80 kg ha⁻¹ was employed, along with recommended fertilizer levels of N: P: K (20:40:20 kg ha⁻¹). The findings showed that plant height, dry matter accumulation, early silking, and maturity were all significantly raised by T₄ (plastic mulch), T₇ (organic herbicide), and T₈ (straw mulch after germination). Due to intense weed competition, the control (T₁) displayed the lowest growth character. According to the study's findings, using plastic mulch, organic herbicide, and straw mulch after germination are sustainable and efficient organic weed control methods that enhance the shape and size of maize. Plastic mulch was found to be the most effective of them.

Keywords: Maize, plastic mulch, straw mulch, organic herbicide and weed control

Introduction

Known as the "Queen of Cereals," maize (*Zea mays* L.) is the third most significant cereal grain crop in India, behind rice and wheat. One of the most adaptable developing crops, maize can be grown in a variety of agroclimatic settings. It can use sun energy more effectively than other crops because it is a C₄ plant. Due to its usage as food, feed, and fodder, maize maintains its socioeconomic significance in Indian agriculture. In addition, it has a number of industrial applications (Dobariya *et al.*, 2014) [7]. In Madhya Pradesh, 136.32 thousand tonnes of maize are produced during the Kharif season on 19 lakh hectares of land (Anonymous, 2024) [3]. Early in its growth, maize is especially vulnerable to weed competition (Rajcan *et al.*, 2001) [12]. In maize, weed competition peaks two to six weeks after seeding (Mhlanga *et al.*, 2001) [16]. This shows how crucial it is to keep the field weed-free during this crucial weed competition phase. Chemical control requires less labor and money than physical and mechanical weeding techniques (Ghersa *et al.*, 1994) [8]. The process of covering the topsoil with plant leaves, grass, twigs, crop leftovers, straw, etc. is known as straw mulching. According to Zhao *et al.* (2014) [15], a mulch layer increases the activity of soil organisms, including vital bacteria like *Rhizobacterium* and *Azotobacter*.

Materials and methods

The current study, "Effect of organic weed management practices on productivity of maize (*Zea mays* L.)," was carried out during the kharif season of 2025-2026 at the Agricultural Research Farm, Faculty of Agriculture Science, Mandsaur University, Mandsaur (M.P.). This farm is located at 24.072389°N latitude and 75.018368°E longitude, with an elevation of 442.16 meters above mean sea level. There were eight treatments in the trial. T₁ served as a control. The manual procedure kept T₂ weed-free. Fifteen days after seeding, T₃ entailed

Hand weeding. Applying plastic mulch was part of T₄. After germination, straw mulch was applied. There were only one hoeing at fifteen. Weeding by hand occurs 30 days after sowing. Hand weeding was done 25 days after seeding, and intercultural operations were performed 45 days later. An organic herbicide was used in T_Ü. The Kaveri Super 2020 cultivar of maize (*Zea mays* L.) was used in the experiment. There were eight treatments, three replications, and a total of twenty-four plots in this Randomized Block Design (RBD) trial. The crop was sowed 45 × 30 cm apart. The net plot size was 4 × 3 m² and the gross plot size was 5.00 × 4.00 m (20.00 m²). The seed rate was 80 kg/ha, while the recommended N: P: K fertilizer dose was 20:40:20 kg/ha.

Result and Discussion

Effect of Organic Weed Management Practices on Plant population at 30 DAS

Under various weed management strategies, the crop's plant population at 30 DAS varied somewhat (Table 1). With 15.40 plants m⁻², T₄ (plastic mulch) had the highest plant population, followed by T₈ (organic herbicide) with 15.26 plants m⁻². Treatments T₅ (straw mulch after germination) and T₇ [manual weeding (25 DAS) and intercultural operation (45 DAS)] both recorded 14.93 plants m⁻², which was comparable to a larger plant population. T₃ (hand weeding at 15 DAS) had a moderate plant population of 14.83 plants m⁻², while T₆ (one hoeing at 15 DAS followed by hand weeding at 30 DAS) had 14.70 plants m⁻².

Under various weed management strategies, the crop's plant population at 30 DAS varied somewhat (Table 1). With 15.40 plants m⁻², T₄ (plastic mulch) had the highest plant population, followed by T₈ (organic herbicide) with 15.26 plants m⁻². Treatments T₅ (straw mulch after germination) and T₇ [manual weeding (25 DAS) and intercultural operation (45 DAS)] both recorded 14.93 plants m⁻², which was comparable to a larger plant population. T₃ (hand weeding at 15 DAS) had a moderate plant population of 14.83 plants m⁻², while T₆ (one hoeing at 15 DAS followed by hand weeding at 30 DAS) had 14.70 plants m⁻².

On the other hand, a significant weed infestation that prevented plants from growing physically was the reason for a decreased plant population under T₁: Control (no weed management). These results are consistent with previous research reported by Zhao *et al.* (2014) [15] and Asif *et al.* (2020) [4], which found that mulching as a weed management technique reduced weed growth, soil moisture conservation, and maize crop productivity. Effective weed control is essential for increasing maize output by reducing crop-weed competition during the critical growth period, according to numerous reports by earlier researchers. Integrated and environmentally friendly weed management techniques greatly enhance crop growth, yield characteristics, and the sustainability of production systems, according to reviews by Sharma and Rayamajhi (2022) [13] and Shrestha *et al.* (2019) [14].

Effect of Organic Weed Management Practices on Plant height at 30 DAS

Plant height at 30 DAS differed under various weed management treatments. Are presented in figure no. 02 (plant population at 30 DAS per 01 meter square of area The tallest plants were recorded in T₄ (Plastic mulch), a height of 91.50 cm, followed by T₈ (Organic herbicide), which recorded 90.26 cm. Treatment T₅ (Straw mulch after germination) also resulted in a higher plant height of 88.06 cm. Moderate plant height was observed in T₃ (Hand weeding at 15 DAS) with 87.26 cm, followed by T₆ [One

hoeing (15 DAS) and hand weeding (30 DAS)] and T₇ [Hand weeding (25 DAS) and intercultural operation (45 DAS)], which recorded 85.93 cm and 85.76 cm, respectively. The minimum plant height was recorded in T₁ (Control) with 75.46 cm, which was distinctly lower than all other treatments, while T₂ (Weed-free manually) recorded 81.80 cm. The improved plant height under T₄ (plastic mulch), T₈ (organic herbicide application), and T₅ (straw mulch after germination) indicates that these treatments effectively reduced weed competition during early growth of plants. Mulching treatments also conserved soil moisture and maintained favourable soil temperature, which enhanced vegetative growth. Reduced plant height observed under T₁ (control) suggests that early weed competition limited nutrient uptake and plant development. The results align with the earlier studies conducted by Kruidhof *et al.* (2009) [9], Mhlanga *et al.* (2016) [10], and Das *et al.* (2019) [6], which reported that brown manuring, cover crop residues, and crop competition approaches were found to be effective in reducing weed pressure and improving yield and profitability.

Effect of Organic Weed Management Practices on Plant height at 60 DAS

Plant height at 60 DAS Treatment T₅ (Straw mulch after germination) also generated taller plants with a height of 178.70 cm. The highest plant height was obtained in T₄ (Plastic mulch), at 185.00 cm, followed by T₈ (Organic herbicide), at 181.80 cm (figure 03). T₆ [One hoeing (15 DAS) followed by hand weeding (30 DAS)] had a moderate plant height of 176.66 cm, followed by T₃ [Hand weeding at 15 DAS] with 173.63 cm and T₇ [Hand weeding (25 DAS) and intercultural operation (45 DAS)] with 172.63 cm. T₁ (Control) had the lowest plant height, measuring 144.50 cm. Increased plant height under T: Plastic mulch and T: Organic pesticide treatment indicates long-term weed control throughout the crucial crop growth stage, guaranteeing improved moisture and nutrient availability. Continuous weed competition during the vegetative period in T₁ limited plant growth, leading to somewhat shorter plants. Several previous researchers additionally show similar patterns of enhanced plant growth using efficient weed management techniques. Prior research by Abouziena and Haggag (2016) [1] and Agrawal *et al.* (2026) [2] also shown similar results regarding plant height under optimal weed control and mulching techniques.

Effect of Organic Weed Management Practices on Plant height at harvest

Increased plant height under T: Plastic mulch and T: Organic pesticide treatment indicates long-term weed control throughout the crucial crop growth stage, guaranteeing improved moisture and nutrient availability. Continuous weed competition during the vegetative period in T₁ limited plant growth, leading to somewhat shorter plants. Several previous researchers additionally show similar patterns of enhanced plant growth using efficient weed management techniques. Prior research by Abouziena and Haggag (2016) [1] and Agrawal *et al.* (2026) [2] also shown similar results regarding plant height under optimal weed control and mulching techniques. Throughout the crop cycle, treatments like T₁ (straw mulch applied after germination), T₁ (organic herbicide application), and T_Ç (plastic mulch) maintained improved growth circumstances, leading to increased final plant height. The detrimental impact of extended weed competition, which limited nutrient uptake, moisture availability, and overall crop

growth, is demonstrated by the lower plant height in T₁ (control). Under these treatments, sustained vegetative development until harvest was supported by constant nutrient availability and decreased crop-weed competition. Previous research have also revealed similar results regarding increased plant height under effective weed management techniques (Brankov *et al.*, 2021; Sharma and Rayamajhi, 2022) ^[5, 13].

Effect of Organic Weed Management Practices on Dry matter accumulation at harvest

Throughout the crop cycle, treatments like T₁ (straw mulch applied after germination), T₁ (organic herbicide application), and T₃ (plastic mulch) maintained improved growth circumstances, leading to increased final plant height. The detrimental impact of extended weed competition, which limited nutrient uptake, moisture availability, and overall crop growth, is demonstrated by the lower plant height in T₁ (control). Under these treatments, sustained vegetative development until harvest was supported by constant nutrient availability and decreased crop-weed competition. Previous research have also revealed similar results regarding increased plant height under effective weed management techniques (Brankov *et al.*, 2021; Sharma and Rayamajhi, 2022) ^[5, 13].

T₁ (Control) had the lowest amount of dry matter accumulation (93.50 g plant⁻¹), followed by T₂ (weed-free manually) with 124.10 g plant⁻¹. Increased photosynthetic efficiency and better assimilate production as a result of successful weed control, better soil moisture conservation, and increased nutrient availability are responsible for the increased dry matter buildup. The crop was able to use available growth resources more effectively and produce more biomass because weeds and plants were less competitive during the active growth period. Due of intense crop-weed competition for nutrients, moisture, and light during the crop growth cycle, the low dry matter buildup under T₁: (Control) results in restricted plant growth. Kumawat *et al.* (2019) ^[17] and Brankov *et al.* (2021) ^[5] have also documented similar patterns of higher biomass output under effective weed management techniques.

Effect of Organic Weed Management Practices on Days taken to 50 per cent silking

The minimum number of days to 50 per cent silking was recorded in T₄ (figure 06) (plastic mulch), 50.22 days, which was followed by T₈ (organic herbicide), 50.26 days, and T₅ (straw mulch after germination), 50.36 days. Treatment T₂ (weed-free manually) also showed early silking with 50.45 days. Moderate days to 50% silking were

observed in T₃ (hand weeding at 15 DAS) with 51.44 days, followed by T₆ (one hoeing (15 DAS) and hand weeding (30 DAS)), which recorded 52.68 days. Treatment T₇ [Hand weeding (25 DAS) and intercultural operation (45 DAS)] required 53.35 days to reach 50% silking. The maximum number of days to 50% silking was recorded in T₁ (control) with 57.48 days. Earlier silking under T₄, T₈, and T₅ as improved growing conditions, better moisture conservation, and reduced weed competition enhanced physiological development and accelerated crop phenological progression. The less stressful conditions under these treatments enabled the crop plants to undergo reproductive growth. The delayed silking in T₁ was caused by growth retardation resulting from intense crop and weed competition for nutrients, moisture, and light, which slowed physiological development. Similar observations regarding earlier reproductive development under efficient weed management practices have also been reported in earlier studies (Rajcan and Swanton, 2001; Mhlana *et al.*, 2016; and Nath *et al.*, 2024) ^[10, 11, 12].

Effect of Organic Weed Management Practices on Days taken to 50 per cent maturity

Days taken to 50 per cent maturity varied under different weed management treatments. Are presented in (figure 07) the minimum number of days to 50% maturity was recorded in T₄ (Plastic mulch) with 87.63 days, closely followed by T₈ (Organic herbicide), which recorded 87.66 days and T₅ (Straw mulch after germination) with 87.97 days. Moderate days to 50% maturity were observed in T₆ [One hoeing (15 DAS) and hand weeding (30 DAS)] with 88.24 days, followed by T₃ (Hand weeding at 15 DAS) with 88.26 days and T₇ [Hand weeding (25 DAS) and intercultural operation (45 DAS)], which recorded 89.53 days. Treatment T₂ (Weed-free manually) recorded 90.52 days to attain 50% maturity. The maximum number of days to 50% maturity was recorded in T₁ (Control) with 92.74 days. Treatments providing effective weed control, particularly T₄, T₈ and T₅, enabled the crop to complete its growth cycle earlier due to improved availability of nutrients, moisture, and light, which enhanced physiological efficiency and accelerated crop development. Reduced competition during the entire crop growth period leads to continuous growth, resulting in comparatively earlier maturity. In contrast, T₁: Control delayed maturity because prolonged weed competition restricted plant growth and slowed metabolic activities. Similar findings were observed in studies conducted by Kumawat *et al.* (2019) ^[17], Nath *et al.* (2024) ^[11], and Agrawal *et al.* (2026) ^[2], as the weed management practices enhance growth and lead to earlier maturity of field crops.

Table 1: Effect of organic weed management practices on plant population (30 das) and different plant height stages of maize

S. No.	Treatments	Treatment combination	Plant Population	Plant height at 30 DAS	Plant height at 60 DAS	Plant height at harvest
1.	T ₁	Control	10.50	75.46	144.50	170.20
2.	T ₂	Weed Free (Manually)	14.56	81.80	163.30	183.83
3.	T ₃	Hand Weeding (15 DAS)	14.83	87.26	173.63	195.50
4.	T ₄	Plastic Mulch	15.40	91.50	185.00	207.56
5.	T ₅	Straw Mulch after germination	14.93	88.06	178.70	220.73
6.	T ₆	One Hoeing (15 DAS) and hand weeding (30 DAS)	14.70	85.93	176.66	192.36
7.	T ₇	Hand weeding (25 DAS) and Interculture operation (45 DAS)	14.93	85.76	172.63	182.33
8.	T ₈	Organic Herbicide	15.26	90.26	181.80	217.53
	SE(m) ±		0.13	0.55	0.82	1.96
	C.D. (p=0.05)		0.40	1.69	2.53	4.21

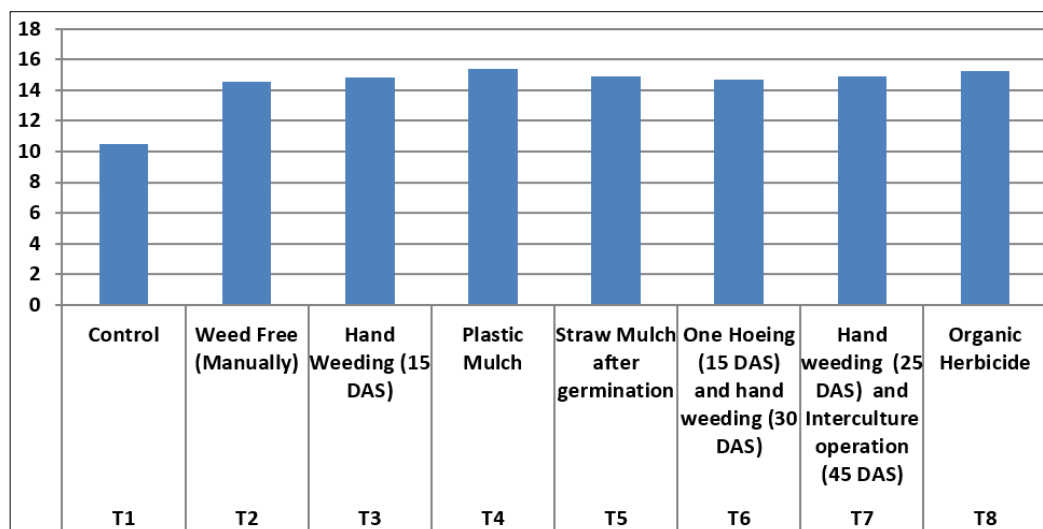


Fig 1: Plant population at 30 DAS per 1 meter square of area

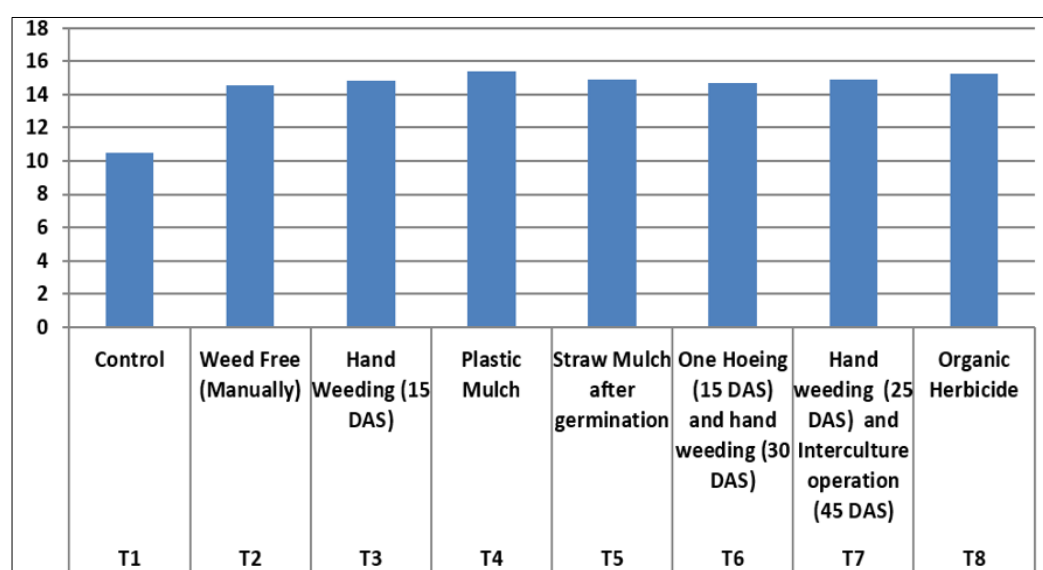


Fig 2: Plant height at 30 DAS

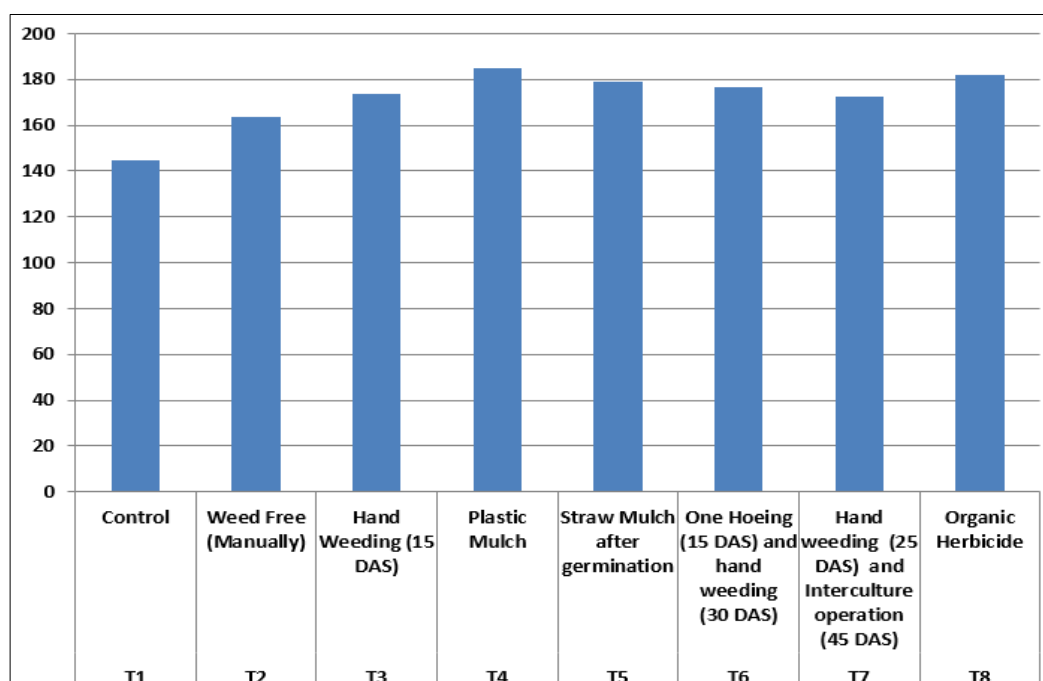


Fig 3: Plant height at 60 DAS

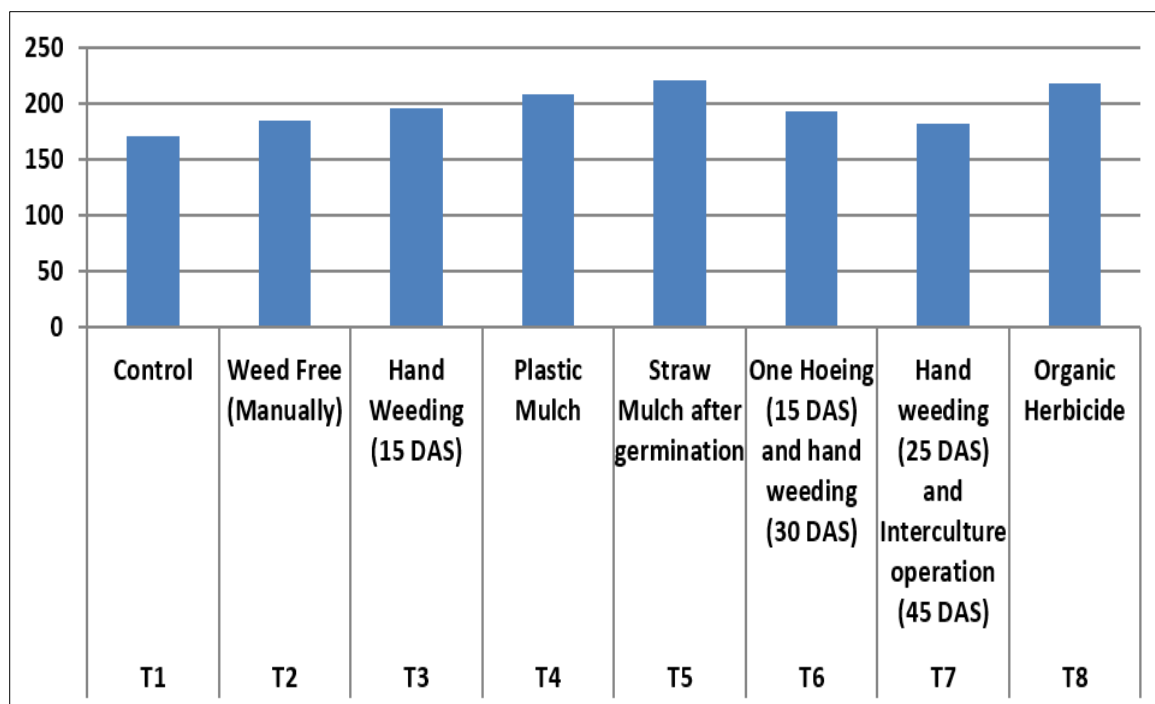


Fig 4: Plant height at harvest

Table 2: Effect of Organic Weed Management Practices on Dry matter accumulation at harvest and days taken to 50% silking & maturity stages of maize

S. No.	Treatments	Treatment combination	Dry matter accumulation at harvest	Days taken to 50% Silking	Days taken to 50% Maturity
1.	T ₁	Control	93.50	57.48	92.74
2.	T ₂	Weed Free (Manually)	124.10	50.45	90.52
3.	T ₃	Hand Weeding (15 DAS)	154.50	51.44	88.26
4.	T ₄	Plastic Mulch	176.76	50.22	87.63
5.	T ₅	Straw Mulch after germination	157.53	50.36	87.97
6.	T ₆	One Hoeing (15 DAS) and hand weeding (30 DAS)	156.93	52.68	88.24
7.	T ₇	Hand weeding (25 DAS) and Interculture operation (45 DAS)	151.33	53.35	89.53
8.	T ₈	Organic Herbicide	166.00	50.26	87.66
SE(m) ±			0.47	0.28	0.22
C.D. (p=0.05)			1.45	0.85	0.69

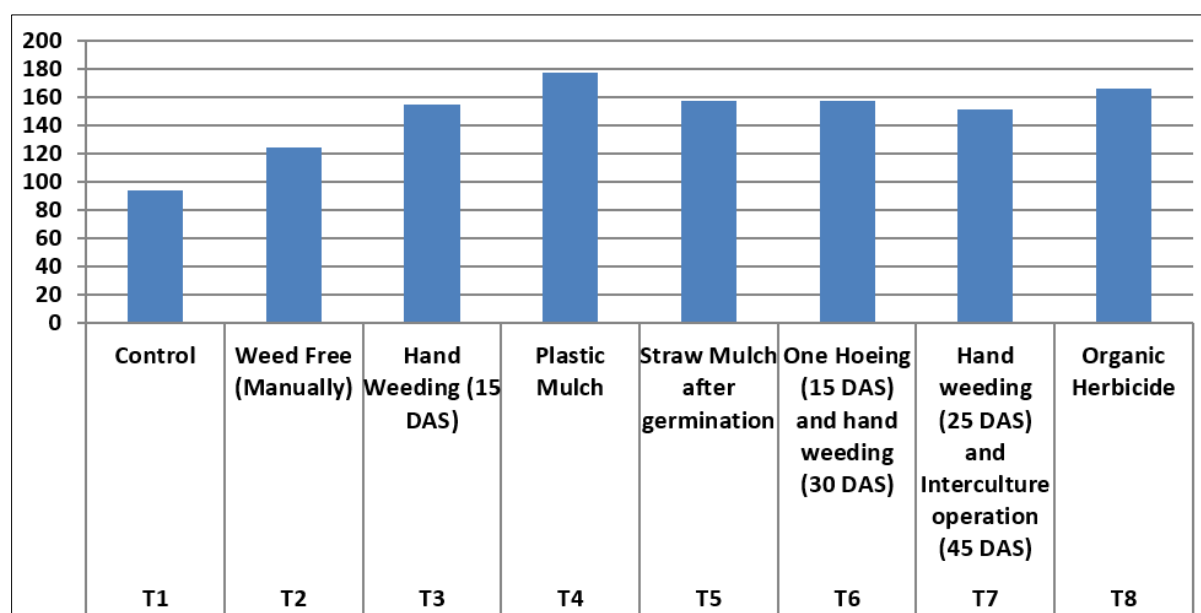


Fig 5: Dry matter accumulation at harvest

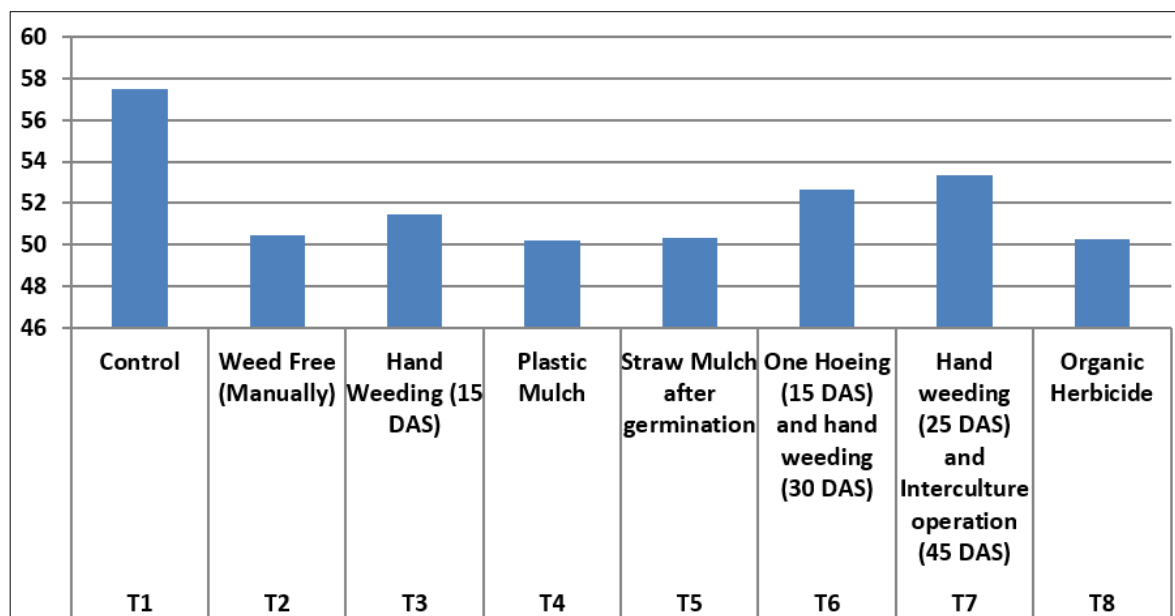


Fig 6: Days taken to 50% silking

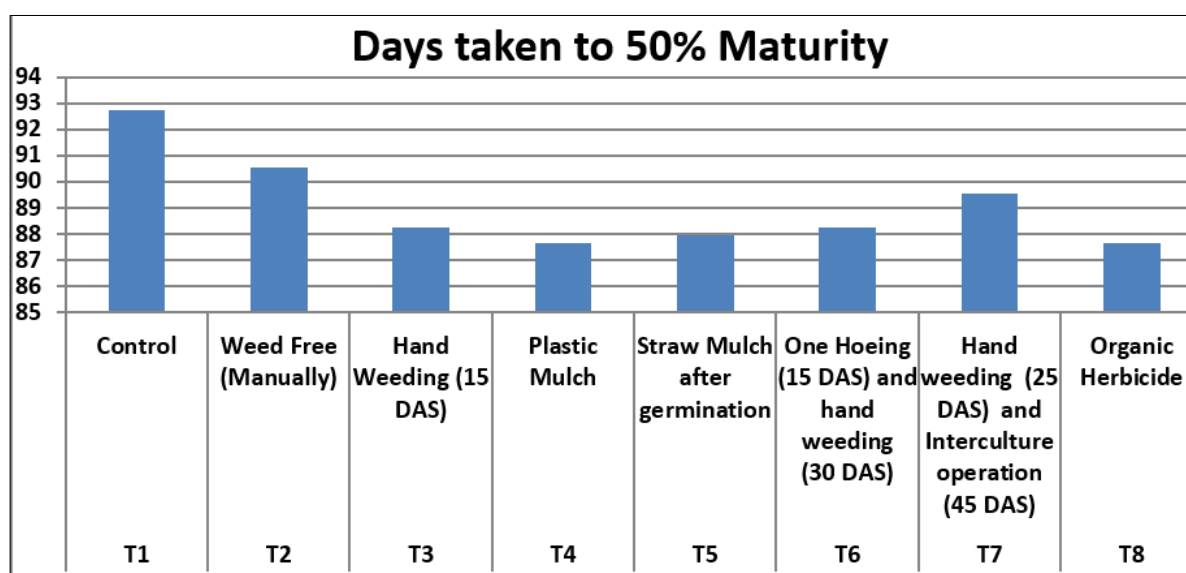


Fig 7: Days taken to 50% Maturity

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