

Agronomic and economic evaluation of sowing methods and mulching for an irrigated wheat (*Triticum aestivum*) in north-west Punjab

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ABSTRACT

A field experiment was conducted during the winter season of 2017–18 at Khalsa College, Amritsar, to study the effect of the method of sowing and different mulch on yield and economics of wheat (*Triticum aestivum* L.) levels in the northwest Punjab region. Wheat was sown on raised beds recorded about 10–12% higher grain yield over zero-till and flat sowing methods. Straw mulch at 4.5 t/ha resulted significant effect on grain yield in wheat. The net returns were more in bed planting and higher mulch levels compared with the other treatments. Straw mulch reduced the maximum soil temperature at seed depth (5 cm) by about 3.7°C compared to the no mulch. During the wheat emergence, raised beds recorded 2.4°C higher soil temperature at 7–8 cm soil depth compared to the flat and zero-till treatments.

Key words: Mulch, Planting, Sowing, Wheat, Zero-till

Wheat (*Triticum aestivum* L.) is the staple food for the majority of the population in the world. Agronomic technologies, such as planting and/or sowing and mulching methods, play a vital role in the establishment of wheat. The aim of placing the seeds at an appropriate depth along with the optimum levels of critical growth inputs and management guarantees better emergence and the subsequent growth of the crop. The bed-sowing technique is useful for improving resource-use efficiency and increasing yield. Mulching is the practice of covering the soil surface with materials such as rice (*Oryza sativa* L.) or wheat straw, etc. It suppresses weeds and helps maintain soil moisture, improving the physical, chemical and biological properties of the soil (Temshah-el, 2017) The beneficial effect of mulch from crop residues is well established and with the introduction of combine harvesters, cereal straw remains in the field as mulch or is incorporated into the soil in developed countries. Farmers use rice straw as food for livestock, as fuel and also for thatching their huts. This study was con-

ducted to compare the methods of planting and mulching with the recommended agricultural practice for expanding the options for managing straw.

The field experiment was conducted during the crop season 2017–18 at the student research farm, Khalsa College Amritsar, Punjab to assess the agronomic productivity of the sowing methods and wheat under different mulching options. The experiment was planted. The soil of the experimental field was sandy clay loam, with pH 7.7. Initially, the soil had organic carbon, available nitrogen, phosphorus and potassium as 0.46%, 168 kg/ha, 18 kg/ha and 335 kg/ha respectively. The treatments consisted of 3 methods of sowing factor (P₁, bed planting; P₂, zero tillage; and P₃, flat sowing) and 4 mulch levels (M₁, no mulch; M₂, rice straw mulch (RSM) @ 3 t/ha; M₃, RSM @ 4.5 t/ha and M₄, RSM @ 6 t/ha, were evaluated in a split-plot design with 3 replications.

The seedling emergence count was not significantly influenced due to different sowing methods (Table 1). Uniform emergence count was recorded in all the main plots. The effect of different mulching treatments on emergence count was also non-significant. The seed index was similar under all planting methods. Mulching @ 6 t/ha (M₄) resulted in significantly highest 1,000-grain weight as compared that of 3 t/ha and no-mulch, but were statistically non-significant.

Different methods of sowing and mulching levels resulted in a significant effect on grain yield (Table 1). Bed

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Table 1. Effect of different methods of sowing and mulch levels on wheat

Treatment	Seedling emergence count/m ²	Seed index (100- seed weight)	Grain yield (t/ha)	Harvest Index	Cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	Benefit: cost
<i>Sowing methods</i>								
Bed planting	67.2	3.79	4.88	46.48	41,105	84,789	43,629	2.06
Zero tillage	65.7	3.47	4.34	44.23	36,715	75,437	38,777	2.05
Flat planting	64.6	3.72	4.42	45.33	38,660	76,825	38,165	1.99
CD (P=0.05)	NS	NS	0.38	-	-	-	-	-
<i>Mulch levels</i>								
No mulch	64.6	3.53	4.28	44.32	34,650	74,414	39,764	2.14
3 t/ha	65.3	3.61	4.41	44.76	39,650	76,652	37,002	1.93
4.5 t/ha	66.6	3.74	4.73	45.85	40,150	82,065	41,915	2.04
6 t/ha	66.9	3.76	4.78	46.48	40,230	82,933	42,703	2.06
CD (P=0.05)	NS	NS	0.22	-	-	-	-	-

planting resulted in significantly higher grain yield (4.88 t/ha) than the other methods of sowing. Bed-planted wheat gave 12 and 10% more grain yield than zero-till and flat method of sowing respectively. These results confirm the findings of Mollah *et al.* (2009) and Temshah-el (2017). Among mulching treatments, RSM @ 6 t/ha showed significantly higher grain yield than no-mulch and RSM @ 3 t/ha but at par with 4.5 t/ha. Results are in line with the findings of Kaur and Mahal *et al.* (2017), Singh *et al.* (2017) and Tolk *et al.* (1999).

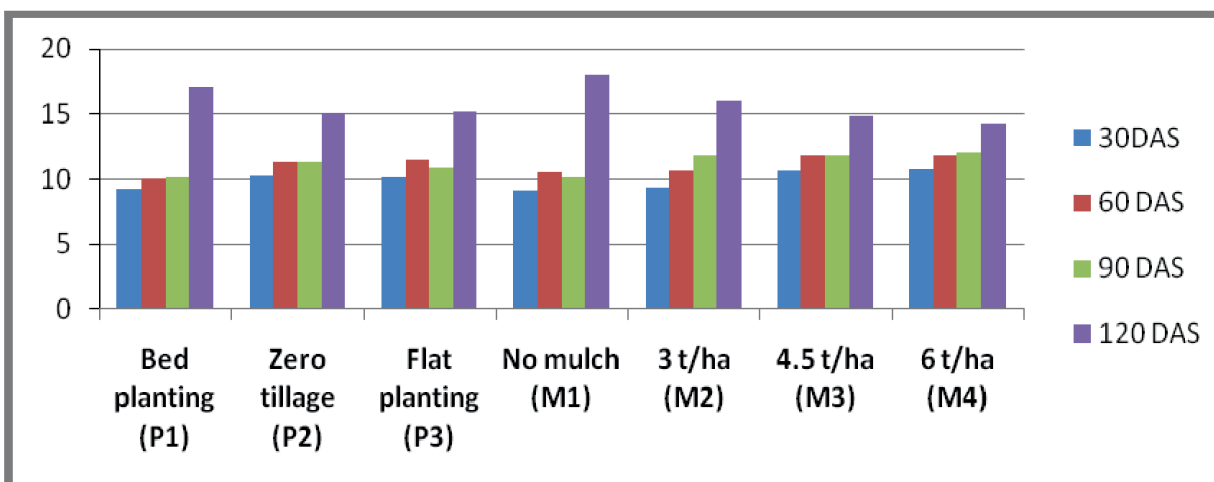
The harvest index indicates the proportion of economic yield to the total biomass production. Among methods of sowing, the highest harvest index was recorded under bed planting (46.48), followed by zero tillage (44.23) and flat planting (45.33). Mulching @ 6 t/ha resulted in higher harvest index (46.48) than the other levels.

Economic analysis of different methods of sowing and mulching levels was calculated by using cost of cultivation, returns and net income. The total cost involved in various operations like seedbed preparation, threshing, seeds, ma-

nure and fertilizer, and threshing were taken into consideration for calculating the cost of cultivation. Net income was estimated by deducing total costs from total returns. Maximum net returns (₹43,629) and benefit: cost ratio (2.06) were obtained with the bed planting. Among mulching levels, application of RSM @ 6 t/ha gave the maximum net returns (₹42,707/ha) and minimum at no-mulch (₹39,764/ha).

Sowing methods and mulching levels did not influence the soil temperature at 30 days after sowing (DAS), but at 60, 90, and 120 DAS sowing methods and mulching levels had a significant effect on soil temperature (Fig. 1). As the mulch level increases the soil temperature increases. Soil moisture was numerically higher with the increase in the mulch levels increased. This was due to less evaporation and a fall in soil temperature due to mulching levels treatments (Fig. 2).

It may be concluded bed planting with residue mulch @ 6 t/ha recorded higher grain yield of wheat.

**Fig. 1.** Effect of different methods of sowing and mulch levels on soil temperature in wheat.

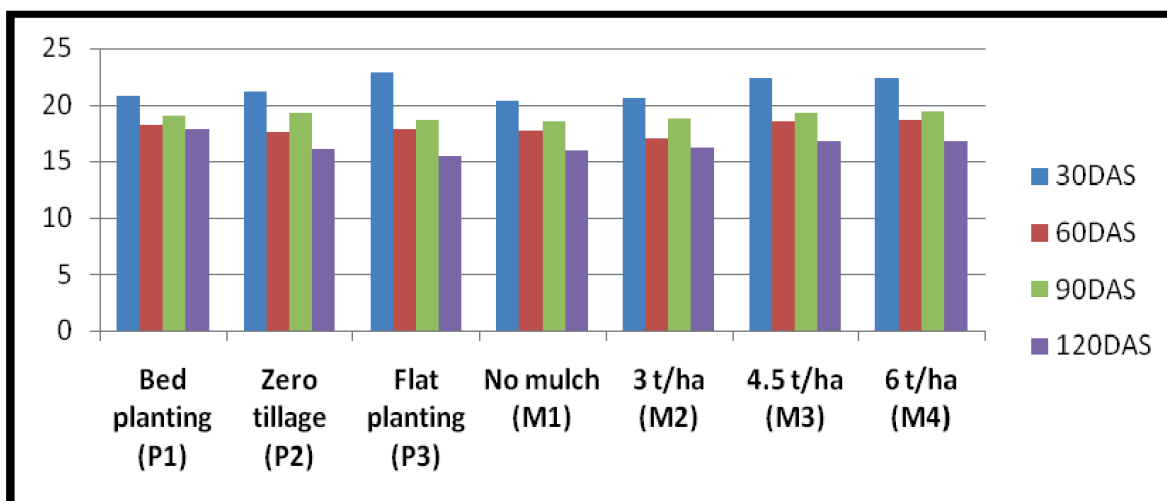


Fig. 2. Effect of different methods of sowing and mulch levels on soil temperature in wheat.

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