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Effect of Silver Oak (*Grevillea robusta*) and Poplar (*Populus deltoides*) based Agroforestry systems on growth and yield attributes of different varieties of Wheat (*Triticum aestivum*) in Dehradun region

Manish Kumar, Amit Larkin and Sameer Daniel

Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, U.P., India

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ABSTRACT

The present investigation titled, "Effect of Silver Oak (*Grevillea robusta*) and poplar (*Populus deltoides*) based Agroforestry systems on growth and yield attributes of different varieties of Wheat (*Triticum aestivum*) in Dehradun region" was carried out to examine the effect of different agroforestry systems on growth and yield attributes of different varieties of wheat crop. Under open condition, VL Gehun 804 variety was found to have average maximum plant height as on 30, 90 and 120 DAS; number of tillers per running row meter as on 60 and 90 DAS; Tiller Production Rate 60-90 DAS; dry weight as on 30, 60, 90 and 120 DAS; number of effective tillers; flag leaf length; spike length; number of grains per spike; grain yield; and Harvest Index. VL Gehun 738 variety was found to have average maximum plant height as on 60 DAS. VL Gehun 907 variety was found to have average maximum number of tillers per running row meter as on 30 DAS and average maximum Tiller Production Rate 0-30 DAS. VL Gehun 401 variety was found to have average maximum Tiller Production Rate 30-60 DAS. VL Gehun 832 variety was found to have average maximum test weight and straw yield. Under Poplar based agroforestry system, VL Gehun 804 variety was found to have average maximum plant height as on 30, 60, 90 and 120 DAS; number of tillers per running row meter as on 30, 60 and 90 DAS; Tiller Production Rate 0-30 DAS; dry weight as on 30, 60 and 120 DAS; number of effective tillers; and flag leaf length. VL Gehun 616 variety was found to have average maximum Tiller Production Rate 30-60 DAS. Both VL Gehun 802 and VL Gehun 829 varieties were found to have average maximum Tiller Production Rate 60-90 DAS. VL Gehun 719 variety was found to have average maximum dry weight as on 90 DAS. VL Gehun 892 variety was found to have average maximum number of grains per spike. VL Gehun 832 variety was found to have average maximum test weight. VL Gehun 832 variety was found to have average maximum spike length and straw yield. VL Gehun 829 variety was found to have average maximum grain yield and Harvest Index. Under Oak based agroforestry system, VL Gehun 804 variety was found to have average maximum plant height as on 30, 60, 90 and 120 DAS; number of tillers per running row meter as on 30, 60 and 90 DAS; Tiller Production Rate 0-30 DAS and 60-90 DAS; dry weight as on 60 and 120 DAS; number of effective tillers; flag leaf length; spike length; and Harvest Index. VL Gehun 719 variety was found to have average maximum Tiller Production Rate 30-60 DAS and dry weight as on 90 DAS. VL Gehun 892 variety was found to have average maximum number of grains per spike. VL Gehun 832 variety was found to have average maximum test weight and straw yield. VL Gehun 829 variety was found to have average maximum dry weight as on 30 DAS and grain yield.

Key words: *Agroforestry, Wheat, Yield attributes, Growth, Tiller production, VL Gehun, Harvest index.*

Introduction

Agroforestry systems have been traditionally well established in Garhwal Himalaya since time immemorial. In the regions where traditional agriculture is practiced, including the Himalayan region and elsewhere in the world, the culturally and socially valued species in agroforestry systems are invariable ecological keystone species within the ecosystem (Rama Krishnan, 2007).

Agroforestry, so far, has been adopted to enhance the productivity of the land, and for mitigating the tangible as well as the intangible deficits of the land and environment. This reflects its dual role of elevating the socio-economic status of the farmers on one hand and mitigating the adverse climatic effects of deforestation to a greater extent by increasing the green cover index, on the other (Sulaiman, 2001). G. robusta is one of the most important trees for agroforestry in the tropical highlands of East and central Africa (Harwood, 1992). Poplars grow fast and mature quickly and because of this ability they are known as 'short-rotation woody crops'. Poplars have proved to be very valuable in satisfying the demand for timber in areas lacking natural forests, especially in the northern hemisphere.

Farmers have the common practice of integrating crops, trees and livestock to solve the problem of shortage of fuel, fodder and other goods (Bhatt 2002). Left with very little opportunities to select the tree species, the farmers incorporate whatever is available on their land (Bhatt *et al.,* 2010). Farmers do realise the importance of trees in a combined production system not only to meet their basic needs, but also for cash benefits (Gupta, 1982 and Puri *et al.,* 1990). Cultivation of Wheat under agroforestry system could be ecologically viable option for greater productivity and economic security of small holders. This system requires information on species compatibility, adaptability, appropriate spatial arrangement of the components and nutrient management practices. Although crops yield decreased in intercropping under agroforestry systems, the careful and wise selection of varieties may reduce the overall financial losses.

Materials and Method

The investigation was carried out during the Rabi seasons 2017 at the Ramola's Agriculture Farm, Selaqui, Dehradun, Uttarakhand, India. Selaqui, Dehradun is in the southern part of the state of Uttarakhand, located at 30.37°N 77.86°E. Dehradun lies in the Doon Valley at the foothills of the Himalayas nestled between the river Ganges on the east and the river Yamuna on the west. The site of experimentation had fairly leveled topography and a good drainage system.

The field soil was sandy-loam type. The experiment was laid out in the Randomize Block Design with three replications. The treatments - T_1 (VL Gehun 401), T_2 (VL Gehun 404), T_3 (VL Gehun 421), T_4 (VL Gehun 616), T_5 (VL Gehun 719), T_6 (VL Gehun 738), T_7 (VL Gehun 802), T_8 (VL Gehun 804), T_9 (VL Gehun 829), T_{10} (VL Gehun 832) T_{11} (VL Gehun 892) and T_{12} (VL Gehun 907) were allotted randomly in each experimental plot. Poplar and Oak trees were planted on bunds of the field with a distance of 4 m. Line sowing of Wheat crop was done in December month in the well ploughed field with N - 60 kg ha^{-1}, P - 40 kg ha^{-1}, K - 30 kg ha^{-1} and $ZnSO_4$ - 20 kg ha^{-1} doses of fertilizers.

The data was recorded for various growth and yield attributes, i.e., plant height and dry weight at 30, 60, 90 and 120 days intervals; number of tillers per running row meter at 30, 60 and 90 days intervals; Tiller Production Rate at 0-30, 30-60 and 60-90 days intervals; and number of effective tillers, flag leaf length, spike length, number of grains per spike, test weight, grain yield, straw yield, Harvest Index and economics of different treatments at maturity.

Results and Discussion

Growth and yield attributes of Wheat crop as affected by differential treatments under open condition are presented in Table 1-8. Results indicate that growth and yield attributes including average maximum plant height as on 30 DAS (17.42 cm), plant height as on 90 DAS (68.54 cm), plant height as on 120 DAS (101.91 cm), number of tillers per running row meter as on 60 DAS (61.52), number of tillers per running row meter as on 90 DAS (132.17), Tiller Production Rate 60-90 DAS (2.31), dry weight as on 30 DAS (3.56 g), dry weight as on 60 DAS (22.31 g), dry weight as on 90 DAS (51.17 g), dry weight as on 120 DAS (135.27 g), number of effective tillers (111.82), flag leaf length (25.98 cm), spike length (14.22 cm), number of grains per spike (72.87), grain yield (37.08 q ha^{-1}) and Harvest Index (41.84) were found to be significant for VL Gehun 804 variety;

average maximum plant height as on 60 DAS (30.85 cm) was found to be significant for VL Gehun 738 variety; average maximum number of tillers per running row meter as on 30 DAS (36.62) and average maximum Tiller Production Rate 0-30 DAS (1.32) were found to be significant for VL Gehun 907 variety; average maximum Tiller Production Rate 30-60 DAS (1.07) was found to be significant for VL Gehun 401 variety; and average maximum test weight (40.18 g) and straw yield (53.92 q ha^{-1}) were found to be significant for VL Gehun 832 variety.

On the other hand, growth and yield attributes of Wheat crop as affected by differential treatments under Poplar based agroforestry system are presented in Table no 1-8. Results indicate that growth and yield attributes including average maximum plant height as on 30 DAS (18.01 cm), plant height as on 60 DAS (36.94 cm), plant height as on 90 DAS

Table 1. Performance of wheat varieties under different conditions.

Treatment	Plant Height (cm) (30 DAS)			Plant Height (cm) (60 DAS)			Plant Height (cm) (90 DAS)		
	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs
T_1	10.21	9.82	11.12	22.91	29.23	31.42	51.14	58.24	55.14
T_2	9.26	10.27	10.22	23.81	32.35	28.86	55.36	58.45	59.02
T_3	9.79	10.11	11.34	23.57	32.33	26.89	61.23	59.53	62.51
T_4	12.05	11.35	9.81	25.68	33.68	33.89	58.42	60.53	62.58
T_5	13.67	14.92	13.25	26.85	34.56	30.97	58.89	64.61	58.78
T_6	16.14	16.75	15.41	30.85	31.58	31.56	61.95	61.93	61.12
T_7	12.57	15.24	14.56	20.52	33.24	32.17	57.16	61.64	64.57
T_8	17.42	18.01	16.67	29.74	36.94	38.83	68.54	70.12	70.14
T_9	13.57	14.66	13.92	21.12	25.97	29.95	56.27	59.42	65.02
T_{10}	16.03	15.24	16.37	22.43	33.62	33.82	56.35	62.57	65.03
T_{11}	13.19	15.12	15.13	24.32	31.67	35.57	63.57	64.34	62.46
T_{12}	14.93	16.17	16.22	30.81	36.14	34.13	64.93	66.37	64.61
F test	S	S	S	S	S	S	S	S	S
S.E±	1.34	1.38	2.47	1.01	2.14	1.87	2.71	2.71	2.55
C.D	2.78	2.86	5.05	2.15	4.53	3.96	5.62	5.62	5.22

Table 2. Performance of wheat varieties under different conditions.

Treatment	Plant Height (cm) (120 DAS)			Number of Tillers per Running Row Meter (30 DAS)			Number of Tillers per Running Row Meter (60 DAS)		
	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs
T_1	77.92	96.67	97.83	12.79	16.45	13.12	42.38	45.64	45.37
T_2	78.13	101.82	100.83	17.82	18.12	23.53	47.35	53.58	52.47
T_3	81.12	103.63	102.13	21.73	26.47	24.78	41.17	44.57	44.83
T_4	85.59	97.36	97.33	20.48	25.48	24.35	43.05	64.28	56.75
T_5	82.69	96.58	94.79	33.01	31.26	22.81	46.48	54.88	60.51
T_6	84.31	105.63	101.76	25.76	29.23	29.43	48.34	53.16	57.71
T_7	90.72	96.28	98.35	29.91	32.47	30.46	46.01	55.39	52.43
T_8	101.91	115.64	112.07	35.33	38.21	36.81	61.52	81.16	71.23
T_9	96.16	104.45	104.01	30.44	29.93	27.53	51.86	58.54	55.47
T_{10}	89.81	101.52	101.38	33.57	27.48	26.24	53.72	70.56	61.48
T_{11}	94.34	104.24	103.87	30.23	27.56	32.45	46.84	62.83	63.64
T_{12}	98.23	107.62	104.68	36.62	35.62	32.76	46.31	57.34	54.71
F *test*	S	S	S	S	S	S	S	S	S
S.E±	1.33	1.65	1.30	2.24	1.30	1.43	2.01	2.24	2.51
C.D	2.76	3.43	2.69	4.64	2.69	2.96	4.02	4.64	5.22

(70.12 cm), plant height as on 120 DAS (115.64 cm), number of tillers per running row meter as on 30 DAS (38.21), number of tillers per running row meter as on 60 DAS (81.16), number of tillers per running row meter as on 90 DAS (132.17), Tiller Production Rate 0-30 DAS (1.20), dry weight as on 30 DAS (3.96 g), dry weight as on 60 DAS (23.71 g), dry weight as on 120 DAS (126.81 g), number of effective tillers (112.83) and flag leaf length (26.12 cm) were found to be significant for VL Gehun 804 variety; average maximum Tiller Production Rate 30-60 DAS (1.39) was found to be significant for VL Gehun 616 variety; average maximum Tiller Production Rate 60-90 DAS (1.98) was found to be significant for both VL Gehun 802 and VL Gehun 829 varieties; average maximum dry weight as on 90

Table 3. Performance of wheat varieties under different conditions.

Treatment	Number of Tillers per Running Row Meter (90 DAS)			Tiller Production Rate (0-30 DAS)			Tiller Production Rate (30-60 DAS)		
	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs
T_1	87.56	97.34	99.85	0.39	0.59	0.54	1.07	1.08	0.98
T_2	108.72	106.45	102.91	0.57	0.60	0.88	0.86	1.17	0.91
T_3	98.13	102.13	101.98	0.81	1.01	0.81	0.69	0.57	0.67
T_4	101.45	97.14	104.25	0.62	0.78	0.81	0.72	1.39	1.10
T_5	110.83	112.26	107.21	0.99	0.96	0.77	0.52	0.74	1.28
T_6	89.66	103.67	109.62	0.87	0.97	1.04	0.72	0.91	0.87
T_7	109.52	116.54	106.54	0.96	0.84	0.91	0.41	0.86	0.68
T_8	132.17	132.17	129.87	1.08	1.20	1.34	0.87	1.25	0.98
T_9	114.13	115.71	117.9	1.00	0.99	0.89	0.69	0.95	0.79
T_{10}	108.49	106.22	104.25	0.98	0.96	1.01	0.73	1.23	1.09
T_{11}	108.78	101.86	108.25	1.07	0.98	1.19	0.51	1.13	0.87
T_{12}	101.91	109.31	111.07	1.32	1.05	1.19	0.28	0.81	0.67
F test	S	S	S	S	S	S	S	S	S
S.E±	1.87	1.71	1.26	.02	.06	.08	.12	.13	.14
C.D	3.96	3.55	2.68	.03	.12	.17	.25	.28	.30

Table 4. Performance of wheat varieties under different conditions.

Treatment	Tiller Production Rate (60-90 DAS)			Dry Weight (g) (30 DAS)			Dry Weight (g) (60 DAS)		
	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs
T_1	1.41	1.79	1.94	1.13	1.61	1.84	9.08	13.45	14.17
T_2	2.09	1.78	1.82	1.62	1.97	2.01	10.87	15.79	16.52
T_3	1.84	1.95	1.89	2.11	2.86	2.67	9.58	12.63	12.36
T_4	1.99	0.98	1.61	1.86	1.92	2.2	12.14	17.98	16.89
T_5	1.11	1.94	1.63	3.17	2.47	2.58	15.09	16.57	16.58
T_6	1.31	1.71	1.64	2.49	2.9	2.87	18.27	14.21	13.87
T_7	2.09	1.98	1.70	2.69	3.71	3.21	15.26	17.06	18.04
T_8	2.31	1.77	2.21	3.56	3.96	3.36	22.31	23.71	21.36
T_9	1.98	1.98	2.01	2.76	2.47	3.59	18.68	16.89	16.41
T_{10}	1.71	1.24	1.47	3.00	2.34	2.14	16.54	21.87	18.74
T_{11}	1.99	1.28	1.57	2.83	2.87	2.98	17.36	19.63	20.55
T_{12}	1.92	1.86	1.84	3.46	3.41	2.97	17.62	19.31	20.36
F test	S	S	S	NS	NS	NS	NS	NS	NS
S.E±	.03	.11	.10	.73	.06	.49	1.58	0.96	.95
C.D	.06	.23	.22	1.55	.12	1.03	3.35	2.03	2.01

DAS (60.67 g) was found to be significant for VL Gehun 719 variety; average maximum number of grains per spike (68.19) was found to be significant for VL Gehun 892 variety; average maximum test weight (40.63 g) was found to be significant for VL Gehun 832 variety; average maximum spike length (13.83 cm) and straw yield (54.27 q ha^{-1}) were found to be significant for VL Gehun 832 variety; and average maximum grain yield (36.88 q ha^{-1}) and Harvest Index (41.11) were found to be significant for VL Gehun 829 variety. Ong (1991) reported a significant effect on growth parameters due to interaction with trees in agroforestry system. Khan and Aslam (1974); Kohli and Saini (2003); and Satish et. al (2003) also reported a decline in the grain yield of Wheat crop under agroforestry system in comparison to the open condition.

Also, the growth and yield attributes of Wheat

Table 5. Performance of wheat varieties under different conditions.

Treatment	Dry Weight (g) (90 DAS)			Dry Weight (g) (120 DAS)			Number of Effective Tillers		
	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs
T_1	32.68	32.68	42.17	89.91	87.06	96.89	66.34	75.83	81.37
T_2	45.51	50.48	50.64	105.65	115.36	111.27	89.57	94.13	89.45
T_3	39.57	48.14	52.68	99.24	109.45	110.89	78.15	87.14	97.28
T_4	41.27	45.52	52.74	103.18	111.76	119.63	84.36	83.28	90.57
T_5	46.18	60.67	65.78	108.54	124.07	116.89	85.57	98.78	91.79
T_6	39.65	43.37	38.12	88.37	93.45	97.84	62.23	87.35	88.87
T_7	48.01	52.33	49.57	111.45	106.34	103.37	96.35	99.61	84.37
T_8	51.17	43.56	47.87	135.27	126.81	128.65	111.82	112.83	117.31
T_9	50.11	43.59	39.11	114.16	107.36	106.84	95.81	98.34	102.65
T_{10}	40.78	35.78	32.34	108.21	103.51	98.58	82.83	86.49	87.24
T_{11}	42.15	31.6	62.51	111.61	97.68	102.85	80.59	91.54	91.33
T_{12}	43.22	44.69	40.67	100.34	106.37	102.17	78.13	96.67	95.58
F test	S	S	S	S	S	S	S	S	S
S.E±	.96	1.17	.96	1.24	1.67	1.95	2.51	2.01	1.55
C.D	2.03	2.42	2.03	2.57	3.46	4.04	5.22	4.02	3.21

Table 6. Performance of wheat varieties under different conditions.

Treatment	Flag Leaf Length (cm)			Spike Length (cm)			Number of Grains per Spike		
	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs
T_1	19.64	19.56	19.74	7.98	8.11	8.16	55.24	52.09	55.68
T_2	22.09	20.35	22.76	9.37	9.55	9.31	61.37	56.25	57.91
T_3	21.98	20.87	22.17	9.80	9.69	9.97	54.13	58.97	56.83
T_4	20.78	20.53	19.86	9.71	9.56	9.68	52.34	51.63	51.27
T_5	23.81	22.89	23.45	9.81	10.12	9.87	59.38	59.36	64.79
T_6	24.10	23.58	20.88	10.78	10.39	10.54	61.74	60.25	59.75
T_7	22.98	20.96	21.52	11.67	11.14	10.43	64.36	61.89	60.24
T_8	25.98	26.12	25.59	14.22	13.77	13.61	72.87	67.74	66.59
T_9	21.38	21.75	21.75	12.34	12.34	11.47	71.47	65.11	67.45
T_{10}	23.54	24.09	22.95	14.01	13.83	12.99	65.82	62.76	60.39
T_{11}	24.11	23.99	23.68	12.99	12.61	12.87	70.43	68.19	68.53
T_{12}	23.49	23.31	22.31	12.68	12.47	12.51	65.35	61.41	61.68
F test	S	S	S				S	S	S
S.E±	1.53	1.51	1.26	.68	.62	.56	4.48	5.13	4.55
C.D	3.19	3.18	2.64	1.41	1.29	1.16	10.07	10.61	9.34

crop as affected by differential treatments under Oak based agroforestry system are presented in Table 1-8. Results indicate that growth and yield attributes including average maximum plant height as on 30 DAS (16.67 cm), plant height as on 60 DAS (38.83 cm), plant height as on 90 DAS (70.14 cm), plant height as on 120 DAS (112.07 cm), number of tillers per running row meter as on 30 DAS (36.81), number of tillers per running row meter as on 60 DAS (71.23), number of tillers per running row meter as on 90 DAS (129.87), Tiller Production Rate 0-30 DAS (1.34), Tiller Production Rate 60-90 DAS (2.21), dry weight as on 60 DAS (21.36 g), dry weight as on 120 DAS (128.65 g), number of effective tillers (117.31), flag leaf length (25.59 cm), spike length (13.61 cm) and Harvest Index (41.21) were found to be significant for VL Gehun 804 variety; average maximum Tiller Production Rate 30-60 DAS (1.28) and dry weight as on 90 DAS (65.78 g) were found to be significant for VL Gehun 719 vari-

Table 7. Performance of wheat varieties under different conditions.

Treatment	Test Weight (g)			Grain Yield (q ha^{-1})			Straw Yield (q ha^{-1})		
	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs
T_1	36.16	36.67	36.71	25.72	25.29	25.27	46.17	47.65	47.08
T_2	36.71	36.91	36.8	26.29	25.89	25.76	47.98	50.11	50.01
T_3	35.92	36.21	36.41	29.53	29.49	29.31	48.67	50.39	50.59
T_4	37.29	37.86	37.65	29.43	28.97	28.85	48.79	50.7	50.78
T_5	37.01	37.35	37.41	30.21	29.85	29.95	49.24	50.97	51.09
T_6	36.71	37	37.09	29.98	29.38	29.35	49.93	51.1	50.11
T_7	39.92	40.09	40.11	30.68	33.24	32.91	50.19	52.4	52.14
T_8	40.14	40.23	40.26	37.08	36.21	36.24	51.28	52.45	51.7
T_9	39.81	40.16	40.15	36.89	36.88	36.71	52.39	52.84	52.51
T_{10}	40.18	40.63	40.57	35.99	35.76	35.71	53.92	54.27	54.12
T_{11}	39.71	39.94	39.98	36.55	36.07	36.11	53.59	54.21	53.79
T_{12}	39.94	40.07	40.03	36.26	36.02	35.98	52.88	53.84	53.49
F test	S	S	S	S	S	S	S	S	S
S.E±	.29	.24	1.26	2.25	.56	.67	.72	.41	.62
C.D	.58	.49	2.64	4.32	1.16	1.56	1.54	.85	1.28

Table 8. Performance of wheat varieties under different conditions.

Treatment	Harvest Index			Grain Yield (q ha^{-1})			Straw Yield (q ha^{-1})		
	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	Oak based A/Fs	Open Condition	Poplar based A/Fs	based based A/Fs
T_1	35.78	34.67	34.93	25.72	25.29	25.27	46.17	47.65	47.08
T_2	35.40	34.07	34.00	26.29	25.89	25.76	47.98	50.11	50.01
T_3	37.76	36.92	36.68	29.53	29.49	29.31	48.67	50.39	50.59
T_4	37.62	36.36	36.23	29.43	28.97	28.85	48.79	50.7	50.78
T_5	38.02	36.93	36.96	30.21	29.85	29.95	49.24	50.97	51.09
T_6	37.52	36.51	36.94	29.98	29.38	29.35	49.93	51.1	50.11
T_7	37.94	38.81	38.69	30.68	33.24	32.91	50.19	52.4	52.14
T_8	41.84	40.84	41.21	37.08	36.21	36.24	51.28	52.45	51.7
T_9	41.44	41.11	41.15	36.89	36.88	36.71	52.39	52.84	52.51
T_{10}	40.03	39.72	39.93	35.99	35.76	35.71	53.92	54.27	54.12
T_{11}	40.55	39.95	40.17	36.55	36.07	36.11	53.59	54.21	53.79
T_{12}	40.68	40.08	40.21	36.26	36.02	35.98	52.88	53.84	53.49
F test	S	S	S	S	S	S	S	S	S
S.E±	.53	.62	.41	2.25	.56	.67	.72	.41	.62
C.D	1.09	1.28	.85	4.32	1.16	1.56	1.54	.85	1.28

ety; average maximum number of grains per spike (68.53) was found to be significant for VL Gehun 892 variety; average maximum test weight (40.57 g) and straw yield (54.12 q ha^{-1}) were found to be significant for VL Gehun 832 variety; and average maximum dry weight as on 30 DAS (3.59 g) and grain yield (36.71 q ha^{-1}) were found to be significant for VL Gehun 829 variety. Khan and Ehrenreich (1994) also reported a decline in the Tiller Production Rate under agroforestry system in comparison to open condition. Nandal *et al*. (1999) also studied the effect of tree canopy on the flag leaf length.

Conclusion

On the basis of the field trials conducted and the subsequent results obtained with specific reference to growth, yield attributes and yield of Wheat crop under open condition and Poplar and Oak based agroforestry systems, the following conclusion can be fairly made that although agroforestry systems may result in reduction of grain yield, the careful and wise selection of varieties may reduce the overall financial losses.

Under open condition, the grain production from VL Gehun 804 variety was 37.08 q ha^{-1}, and the grain production from VL Gehun 804 variety under Poplar and Oak based agroforestry systems was 36.21 q ha^{-1} and 36.24 q ha^{-1} respectively, which showed reduction in grain yield under agroforestry systems in comparison to the open condition. On the other hand, the grain production from VL Gehun 829 variety under Poplar and Oak based agroforestry systems was 36.88 q ha^{-1} and 36.71 q ha^{-1} respectively, which showed increase in grain yield under agroforestry systems in comparison to the open condition.

Further, it can also be concluded that plant height, number of tillers per running row meter, Tiller Production Rate, dry weight, number of effective tillers, flag leaf length, spike length, number of grains per spike, test weight, grain yield, straw yield and Harvest Index were found to be significantly influenced by different treatments under open and agroforestry conditions.

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