



## Performance of Wheat Varieties Intercropped with Poplar (*Populus deltoides*) Plantation

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### ABSTRACT

In the present study, field experiment was conducted during 2007-08 to evaluate growth and yield of wheat varieties grown in association with three year old poplar (*Populus deltoides*) plantation of clone WSL 22 planted at a spacing of 5 x 4 m at the experimental farm of Doon College of Agriculture Science and Technology, Dehradun, Uttarakhand. Twelve wheat varieties namely (UP-2338, UP-262, Raj-3077, PBW-154, HD-2285, HD-2329, RR-21, UP-2113, UP-2003, PBW-226, PBW-373, PBW-343) were grown and evaluated under poplar based agroforestry. The growth and yield attributes were recorded for wheat varieties. Maximum number of tillers were observed in variety T<sub>1</sub>- UP-2338 (102.8/m<sup>2</sup>) followed by T<sub>3</sub>- Raj-3077 (97.2/m<sup>2</sup>). The other varieties produced a significantly lower number of tillers than T<sub>1</sub>. Highest plant height was recorded in T<sub>8</sub>- UP-2113 (108.0 cm) while lowest was in T<sub>2</sub>- UP-262 (82.6 cm). The grain yield was significantly higher for T<sub>1</sub>- UP-2338 (32.2 q/ha) over the T<sub>3</sub>- Raj-3077 (29.3q/ha), which was superior over all other treatments.

### Keywords:

Agrosilviculture, poplar, varieties, wheat, yield

### INTRODUCTION

Poplar (*Populus deltoides*) is extensively grown agricultural fields as a tree component in commercial agroforestry in parts of Punjab, Haryana, Uttarakhand and Western Uttar Pradesh and some adjoining states (Lal 2007). The tree has been accepted by the farmers for its enabling characters to allow successful cultivation of agricultural crops under its canopy for a greater period of their retention on the fields. Farmers grow poplar for its better integration with agricultural crops, easy sale of wood and invariably better and remunerative returns its sale. Poplar has now become one of the ideal commercial tree for integration with agricultural crops in its region of

farming and the common crops grown with it include sugarcane in the first two years, wheat during winters and some vegetables and other crops during summers (Dhiman 2006). Search for new crop giving good yield and return has always been attempted. Of late, some studies have started focusing on screening agricultural crop varieties for cultivation under farm grown tree plantations for higher yields (Nandal et al. 1997; Singh et al. 1993). Some studies have started focusing on screening agricultural crop varieties for cultivation under farm grown trees plantations for higher productivity (Singh et al. 1993; Nandal et al. 1997). Wheat is one of the major crop which provide better and remunerative returns to its growers under

poplar based agroforestry system. The present study was therefore conducted to evaluate the performance of twelve wheat varieties under three-year-old poplar plantation.

## MATERIALS AND METHODS

An experiment was conducted at the Research Farm of Doon College of Agriculture Science & Technology located at 30°21' N latitude, 77°52' E longitude and at an altitude of 516.5 mamsl, Selaqui of Dehradun, Uttarakhand. Annual rainfall of the locality varies from 1500 to 1800 mm and the relative humidity varies from 66 to 95 %. This locality experiences a humid subtropical climate with hot, dry summer and cool winter. A total of 30.2 mm rainfall was recorded during the period of experimentation, mainly during the first week of April (24.9 mm). During the period of November 2007 to April 2008, maximum (37.2°C) and minimum (17.9°C) temperature was recorded in the third week of April and fourth week of January respectively. The soil of experimental site was sandy loam in texture with a pH of 6.9, EC 0.43%, organic carbon 0.48%, total nitrogen 210.2 kg ha<sup>-1</sup>, available phosphorus 19.44 kg ha<sup>-1</sup>, and available potassium 271.28 kg ha<sup>-1</sup>.

Wheat (*Triticum aestivum*) seed of 12 varieties viz; UP-2338 (T<sub>1</sub>), UP-262 (T<sub>2</sub>), Raj-3077 (T<sub>3</sub>), PBW-154 (T<sub>4</sub>), HD-2285 (T<sub>5</sub>), HD-2329 (T<sub>6</sub>), RR-21 (T<sub>7</sub>), UP-2113 (T<sub>8</sub>), UP-2003 (T<sub>9</sub>), PBW-226 (T<sub>10</sub>), PBW-373 (T<sub>11</sub>), PBW-343 (T<sub>12</sub>) was sown during the first week of November, 2007 in three replications under randomized block design (RBD) under three years old poplar plantation of clone WSL 22 established at 5 m X 4 m spacing. Wheat seed @ 100 kg ha<sup>-1</sup> was sown in 4 to 5 cm shallow furrows at the spacing of 20 cm between the rows made with the help of tractor drawn seed drill and the field was leveled after seed sowing with the help of wooden planker. Fertilizers @ 120 kg N ha<sup>-1</sup>, 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> and 40 kg K<sub>2</sub>O ha<sup>-1</sup> were applied through urea, granular single super phosphate and murate of potash, respectively.

Crop growth, yield and yield attributing characters were recorded at the time of harvesting the wheat crop during the third week of April, 2008. The data obtained during the course of this investigation were statistically analyzed, standard error of mean (S. Em<sub>±</sub>) calculated and the critical

differences (CD) at the 5 % probability level was calculated in comparing the treatment means (Steel and Torrie 1980).

Harvest index is the ratio of economic yield (grain yield) to biological yield and was calculated by using the following formula:

$$\text{Harvest Index} = \frac{\text{Grain yield (ha}^{-1}\text{)}}{\text{Biological yield (ha}^{-1}\text{)}}$$

## RESULTS AND DISCUSSION

The results on growth and yield attributes obtained in the investigation are presented in Table 1 and Table 2, respectively. Data presented in Table 1 indicates significant differences in mean values for number of tillers/m<sup>2</sup> area, plant height, spike length, number of grains/spike and 1000 grain weight for different varieties of wheat crop grown under poplar plantation. Results revealed that the wheat variety UP 2338 had produced maximum number of tillers/m<sup>2</sup>, spike length, number of grains/spike and 1000 grains weight followed by that of variety Raj-3077.

The mean values for number of tiller/m<sup>2</sup> area was significantly higher in variety UP 2338 when compared with that in other varieties under study. Significant differences in the number of tillers due to different varieties grown under poplar plantation were also observed by Jain (1998). However, the data on plant height showed that UP-2113 (108.0 cm) had produced significantly tallest plants, whereas, HD-2329 (79.9 cm) was shortest. This behaviour of wheat varieties is under genetic control and therefore, varieties differed in plant height. Singh (1993) also reported that significant differences in plant height of wheat varieties grown under agroforestry system.

The data for number of spikes m<sup>2</sup> area for variety UP 2338 had significantly maximum (76.6) number than rest of varieties whereas, the minimum (61.0) was in variety T<sub>2</sub>- UP-262. The variation in number of spikes per meter row length in wheat varieties could be correlated with their tillering ability. Similar results were obtained by Singh (1993) and Jain (1998). For spike length results revealed that the spike length was maximum (10.7 cm) in UP 2338-T<sub>1</sub> while, minimum (7.0 cm) was in T<sub>9</sub>- UP-2003. UP 2338-T<sub>1</sub> produced

**Table 1:** Growth and yield attributes of wheat varieties under poplar plantation

Treatments	No. of tillers/m <sup>2</sup> area	Plant height (cm)	No. of spikes/ /m <sup>2</sup> area	Spike length (cm)	No. of fertile spikelets/ spike	No. of grains/spike	1000 grains wt. (gm)
T <sub>1</sub> - UP -2338	102.8	102.0	76.6	10.7	15.8	41.2	39.9
T <sub>2</sub> - UP -262	84.4	82.6	61.0	8.8	14.8	34.8	29.2
T <sub>3</sub> - Raj -3077	97.2	98.7	70.6	10.1	15.2	39.6	36.6
T <sub>4</sub> - PBW -154	88.7	94.7	62.0	9.3	15.0	35.0	32.4
T <sub>5</sub> - HD -2285	90.0	83.2	70.4	8.0	14.2	36.2	35.0
T <sub>6</sub> - HD -2329	89.4	79.9	65.6	9.6	15.6	36.0	33.5
T <sub>7</sub> - RR -21	76.2	84.5	59.8	6.0	11.6	30.6	26.6
T <sub>8</sub> - UP -2113	83.0	108.0	58.6	8.5	14.4	33.4	31.4
T <sub>9</sub> - UP -2003	84.6	90.7	64.4	7.0	13.2	32.0	24.9
T <sub>10</sub> - PBW -226	93.4	91.3	69.6	9.6	14.7	39.0	39.1
T <sub>11</sub> - PBW -373	86.5	96.3	63.4	7.6	14.0	34.6	33.2
T <sub>12</sub> - PBW -343	90.5	88.7	67.0	9.3	13.8	37.3	35.8
S.Em. ±	1.2	1.3	1.1	0.14	0.20	0.49	0.51
CD at 5 %	3.5	3.9	3.2	0.43	0.58	1.50	1.51

higher (15.8) number of fertile spikelets/ spike however, it was statistically similar to Raj-3077-T<sub>3</sub>(15.2)and T<sub>6</sub>- HD-2329 (15.6).These findings are in line with that of by Jain (1998). Number of sterile spikelets/ spike (5.4) were maximum in T<sub>8</sub>- UP-2113 whereas, the lowest (1.6) recorded in T<sub>1</sub>- UP-2338. In case of number of grains per spike maximum value was recorded for UP 2338-T<sub>1</sub> (41.2) followed by Raj-3077-T<sub>3</sub> (39.6), PBW 226-T<sub>10</sub> (39.0). UP 2338- T<sub>1</sub> was found superior than all other varieties. Raj-3077-T<sub>3</sub> (39.6) and PBW 226-T<sub>10</sub> (39.0) were at par with each other, but significantly higher than the rest of the varieties for this trait. Significant genetic variation in the number of grains per spike of wheat varieties were also confirmed by Puri and Bhangarwa (1992). In case of 1000 grain weight, UP 2338-T<sub>1</sub> showed maximum value (39.9 g) which was at par with that of PBW 226-T<sub>10</sub> (39.1 g). These two varieties were superior over the other varieties. Liyanage and Martin (1986) also supported significant genotypic variation in 1000 grain weight under poplar-based agroforestry system.

Grain yield of different wheat varieties was significantly influenced under poplar based agroforestry system (Table 2). Maximum grain yield

was recorded for variety T<sub>1</sub>(32.2qha<sup>-1</sup>) followed by T<sub>10</sub> (29.6 qha<sup>-1</sup>) and T<sub>3</sub> (29.1 qha<sup>-1</sup>). The yield of T<sub>1</sub> was significantly higher than for the rest of the varieties. Other nine varieties resulted statistically similar yield. The maximum straw yield produced in treatment T<sub>1</sub> (57.4 qha<sup>-1</sup>) and treatment T<sub>3</sub> (52.5 qha<sup>-1</sup>) ranked second. While, the minimum straw yield was produced in T<sub>7</sub> (29.7 qha<sup>-1</sup>) than all other treatments under study. Total biological yield was also maximum in treatment T<sub>1</sub> (89.6 qha<sup>-1</sup>) followed by treatment T<sub>3</sub> with an average biological yield of (81.7 qha<sup>-1</sup>). Whereas, minimum in treatment T<sub>7</sub> (46.7 qha<sup>-1</sup>). The maximum biological yield could be correlated to higher photosynthetic efficiency (more number of shoots per unit area with higher leaf area index). These results have clearly shown the wide variation in grain, straw and biological yields of wheat varieties, as also reported by Singh et al. (1993) and Jain (1998). The results on harvest index revealed that the maximum harvest index (0.399) was observed in T<sub>2</sub>- UP-262, but it was statistically at par with the T<sub>5</sub>- HD-2285 (0.385) and T<sub>6</sub>- HD-2329 (0.395). This variation in harvest index among the treatments may be because of differ in respect to their grain yield potential.

Wheat is one of the main crop grown in

**Table 2:**Yield of wheat varieties under poplar plantation

Treatments	Grain yield (qha <sup>-1</sup> )	Straw yield (qha <sup>-1</sup> )	Biological yield (qha <sup>-1</sup> )	Harvest index
T <sub>1</sub> - UP-2338	32.2	57.4	89.6	0.359
T <sub>2</sub> - UP-262	21.7	32.7	54.4	0.399
T <sub>3</sub> - Raj-3077	29.1	52.5	81.7	0.356
T <sub>4</sub> - PBW-154	23.6	40.2	63.8	0.370
T <sub>5</sub> - HD-2285	26.4	42.1	68.5	0.385
T <sub>6</sub> - HD-2329	25.9	39.6	65.5	0.395
T <sub>7</sub> - RR-21	16.9	29.7	46.7	0.362
T <sub>8</sub> - UP-2113	20.5	36.7	57.2	0.358
T <sub>9</sub> - UP-2003	20.3	36.2	56.5	0.359
T <sub>10</sub> - PBW-226	29.6	49.0	78.6	0.377
T <sub>11</sub> - PBW-373	22.1	40.7	62.8	0.352
T <sub>12</sub> - PBW-343	26.4	43.1	69.5	0.380
S.Em. ±	0.3	0.6	1.1	0.005
CD at 5 %	0.8	1.9	3.4	0.015

poplar based agroforestry and many of its varieties are being tested for growing under poplar. The present study indicates that UP 2338 variety has been found suitable for growing under poplar plantation. This variety was found superior in relation to growth, yield attributes under poplar based agroforestry.

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