# LEAF FALL IN POPLAR AND ITS IMPACT ON WHEAT INTERCROP

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## Introduction

Poplar (*Populus deltoides*) is an important component species of agroforestry system in the plains of Punjab, Haryana and Western Uttar Pradesh. The importance of Poplar in Indian agroforestry was realised in the early 1980s (Chaturvedi, 1982). Since then, it has spread widely in the agro-ecosystem of the region. It is planted either at 3 m to 4 m spacing in linear rows on one or more borders of agricultural fields or at 5 m x 4 m spacing throughout the agricultural fields. Field crops e.g. wheat, sugarcane, sunflower, mustard, oat, maize, vegetables, pulses, etc. are grown in the field in various temporal sequences in the above spatial arrangements with Poplar.

Poplar is deciduous and sheds its leaves during autumn season. The leaves decompose slowly and continue to affect the intercrop for a considerable length of time (Tewari, 1993). Wheat is the major Rabi crop of the Poplar-growing region of India. To reduce the detrimental effect of the shed leaves on wheat crop, the farmers prefer to grow late-sown varieties of wheat and periodically remove the leaf litter. Singh *et al.* (1999) observed that fallen leaves near Poplar trees might be one of the factors that adversely affect the growth of wheat crop in agroforestry. Singh *et al.* (1987) carried out a general survey and reported the period of the year when leaf fall in some clones of Poplar is completed in Udham Singh Nagar area. The pattern of leaf fall of Poplar trees and the effect of its removal on growth and yield of wheat crop have not been studied. This paper gives the results of a study conducted to fill this gap in knowledge and suggests the frequency of removal of leaf litter and other options for reducing harmful effect on wheat crop.

## Material and Methods

The study was carried out at village Khubbanpur, Tehsil Roorkee, District Hardwar, Uttar Pradesh (now Uttaranchal). A four-year old block plantation of clone G48 of Poplar was selected. The spacing of trees in the plantation was 5m x 4m. Variety PBW 3077 of wheat was sown on December 2, 1997 throughout the plantation. The same variety was also sown in an open field near the plantation to serve as control. Sixteen plots of size 5m x 4m, with Poplar trees on the corners, were marked in the plantation. Four replications of the following four treatments of litter removal frequency were allocated in the plots in randomised

complete block design (T1) twice per week, (T2) once per week, (T3) once per two weeks, and (T4) no removal. Leaf litter was initially removed on December 18, 1997 from plots of treatments T1, T2 and T3; litter was not removed from T4. Seedlings had already emerged from the ground by that time. Thereafter, leaves were removed from plots as per the above schedule. Leaf fragments smaller than one square inch area were not removed. The last removal of leaf litter was done on January 15, 1998; trees had become almost leafless by that time. At each collection time, sample of leaf litter of 10 $m^2$ area in each plot was brought to the laboratory. The leaves were dried at 60°C for 7 days in an oven and weighed.

The wheat crop matured in the third week of April 1998. Number of plants, plant height, ear length, grain yield and 100 seed weight in 25 cm x 25 cm sized quadrats in all plots were recorded at the time of crop harvest.

**Results and Discussion**

Table 1 shows that the quantity of leaf litter produced per day was maximum on December 20 and it gradually decreased as winter progressed. When litter was collected twice a week, litter collection per day was 45 g/10$m^2$ area on Dec. 20 which decreased to 11.08 g/10 $m^2$ area on Jan. 15. It can be seen that the total quantity of leaves removed in T1 (Dec. 22 + Dec. 15) > T2 (25 Dec.), T1 (Dec. 29 + Jan. 1) > T2 (Jan. 1) and T1 (Jan. 5 + Jan. 8) > T2 (Jan. 8). Similarly it was also found that litter collected in T2 (Dec. 25 + Jan. 1) > T3 (Jan. 1), and T2 (Jan. 8 + Jan. 15) > T3 (Jan. 15). The inequality points toward the decomposition or fragmentation of leaves on the ground, although slowly, with the passage of time. Leaf litter collected from the field on Dec. 18 was as high as 862.5 g/10 $m^2$.

Table 2 shows that the density of intercropped wheat plants was significantly increased by removing the leaf litter once

**Table 1**

*Quantity of Poplar leaf litter collected at different litter collection frequencies in Poplar block plantation of 5m x 4m spacing*

| Litter collection frequency | Total and average litter collection ( g per 10 $m^2$ area) on different dates | | | | | | | | Critical difference (5%) |
|---|---|---|---|---|---|---|---|---|---|
| | 22 Dec. | 25 Dec. | 29 Dec. | Jan. 1 | Jan. 5 | Jan. 8 | Jan. 12 | Jan. 15 | |
| Twice per week (T1) | 180.00 (45.00) | 73.50 (24.50) | 97.75 (24.43) | 76.75 (25.58) | 67.00 (16.75) | 41.50 (13.83) | 40.75 (10.19) | 33.25 (11.08) | 20.54 (5.85) |
| Once per week (T2) | - | 222.5 (31.8) | - | 140.00 (20.00) | - | 87.50 (12.5) | - | 78.00 (11.1) | 18.51 (2.93) |
| Once per two weeks (T3) | - | - | - | 345 (24.64) | - | - | - | 130 (9.28) | 65.91 (4.71) |

Note : Figures within parentheses indicate average litter removal per day; figures outside parentheses are total litter removal on the particular dates. '-' indicates litter was not collected on that date.

**Table 2**

*Growth and yield of wheat as affected by intercropping and frequency of removal of Poplar leaf litter*

| Wheat growth and yield per quadrat (25 x 25 cm²) | Intercropped wheat | | | | Control i.e. wheat in open field (T5) | Critical difference (5%) |
|---|---|---|---|---|---|---|
| | Twice per week (T1) | Once per week (T2) | Once per fortnight (T3) | No removal (T4) | | |
| No. of plants | 40.00 | 38.50 | 35.00 | 30.00 | 36.80 | 6.31 |
| Plant height (cm) | 69.10 | 65.60 | 66.00 | 67.10 | 94.60 | 5.79 |
| Ear length (cm) | 5.08 | 4.71 | 4.66 | 4.66 | 8.19 | 0.60 |
| Grain yield (g) | 20.91 | 19.26 | 16.92 | 14.93 | 37.42 | 4.36 |
| 100-seed weight (g) | 3.83 | 4.08 | 3.73 | 3.99 | 3.94 | N.S. |

or twice per week in comparison with no removal. The increase can be attributed do lesser physical suppression-related mortality in plots frequently cleared of leaves. T1, T2, T3 and T4 were on a par with one another in respect of height, ear length and 100 seed weight suggesting that removal of leaf litter did not affect these characteristics. This implies that wheat seedlings that could penetrate the overlying leaf litter to get sunlight could grow as good as those intercropped seedlings which were not overlaid by leaf litter. However, grain yield per quadrat was significantly increased by removing the leaf litter once or twice per week because of increased survival. It is also expected that if removal of leaf litter were done while wheat seeds were germinating and seedlings were emerging out of soil, the yield of intercropped wheat could have further increased due to greater and quicker germination.

Despite frequent removal of Poplar leaf litter in intercropped wheat crop, the plant height, ear length and yield of intercropped wheat were significantly lower than in open field. Grain yield in the open was 37.42 g/quadrat in contrast with merely 20.91 g/quadrat in intercropped wheat plots cleared of tree litter twice a week (T1) or 14.93 g/quadrat in intercropped plots without clearing leaf litter (T4). The average seed weight of intercropped wheat and open wheat were not significantly different. The existence of significant difference between intercropped wheat and open wheat in respect of plant height and ear length suggests that shade of leaves present on trees after the sowing time might have reduced germination speed or early seedling growth of the intercrop.

It suggests that there is a need to develop clones of Poplar that would shed leaved early. It will obviate the need of raising late-sown varieties of wheat. Conversely, it will lead to quicker germination and early growth of a given variety of wheat. To the farmer, this study suggests that removal of leaves of Poplar trees once a week, till the seedlings fully emerge out of leaf litter, can help in

increasing wheat yield significantly. But precaution must be taken not to trample the wheat plants while removing leaf litter. Another option worth trial is to sow wheat very early or very late so that its germination and early growth period (which is about one month) does not coincide with leaf fall of Poplar.

## Conclusion

*Survival and yield of wheat* intercropped in four-years-old block plantation of Poplar can be significantly increased by removing Poplar leaf litter once a week during germination and initial growth period of late-sown wheat.

## SUMMARY

**The decomposition of Poplar leaf litter is very slow; this has detrimental physical effect on wheat intercrop. Survival and yield of late-sown variety of intercropped wheat were significantly increased by weekly removal of Poplar leaf litter in four-year-old block plantation of Poplar raised at 5m x 4m spacing. However, despite removal of leaf litter at such frequent intervals, yield of intercropped wheat crop is quite low in comparison with open field. Alternative R&D options for reducing the harmful physical effect of Poplar leaf fall on wheat crop have been suggested.**

## पोपलर की पत्तियां झड़ना और गेंहू की अर्न्तवर्तित फसल पर उसका प्रभाव

दिनेश कुमार, पवन कुमार व प्रदीप कुमार

### साराश

पोपलर से गिरी पत्तियों का विघटन बहुत धीरे-धीरे होता है, जिसका गेंहू की अर्न्तवर्तित फसल पर बहुत हानिकर प्रभाव पड़ता है । अर्न्तवर्तित गेंहू की पहली किस्म बोई जाने पर उसकी अतिजीविता और उसकी प्राप्ति उस समय काफी बढ़ गई जब पौधों के बीच 5 सेमी x 4 सेमी फासला छोड़कर लगाए 4 वर्षीय पोपलर रोपवन पर्णास्तरण को सप्ताहवार निकाला जाता रहा । तथापि, इनती अधिक बारम्बारता वाले अन्तराल पर पर्णास्तरण निकाले जाते रहने पर भी खुले खेतों के मुकाबले में अन्तफसल की प्राप्ति कम रही । गेंहू की फसल पोपलर की पत्तियां झड़ने के हानिकर भौतिक प्रभावों को कम करने के लिए वैकल्पिक अनुसन्धान एवं विकास विकल्पों को भी सुझाया गया है ।

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