

## NOTE ON PADDY TRANSPLANTION DATE

Over exploitation of groundwater in paddy growing areas is one of the major challenges threatening the sustainability of agriculture in the region. Apart from crop diversification, water saving interventions in rice itself can help in preventing further aggravation of this situation.

### **Fixing of date for paddy nursery sowing and its' transplanting as a means of saving water:**

Evapo-transpiration losses in May-June are very high. A policy/regulatory intervention stipulating the start date for nursery planting and transplantation which avoids major part of hot-dry season was introduced in the state. Towards this end, an ordinance was issued in 2008 that made it mandatory for the farmers not to seed rice nursery before 10<sup>th</sup> May and not to transplant before 10<sup>th</sup> June. This was converted into a water saving regulation: 'The Punjab Preservation of Sub-soil Water Act' in 2009.

**Table 1: Fall in water table in Punjab vis-à-vis annual rainfall and area under paddy in the state over the years**

Period	Average decline in water table (cm/year)	Average Rainfall (cm)	Average area under Paddy (lakh ha)
1990 - 2000	25	64	22.5
2000 – 2008*	84	39	26.1
2008 - 2017	53	52	28.1

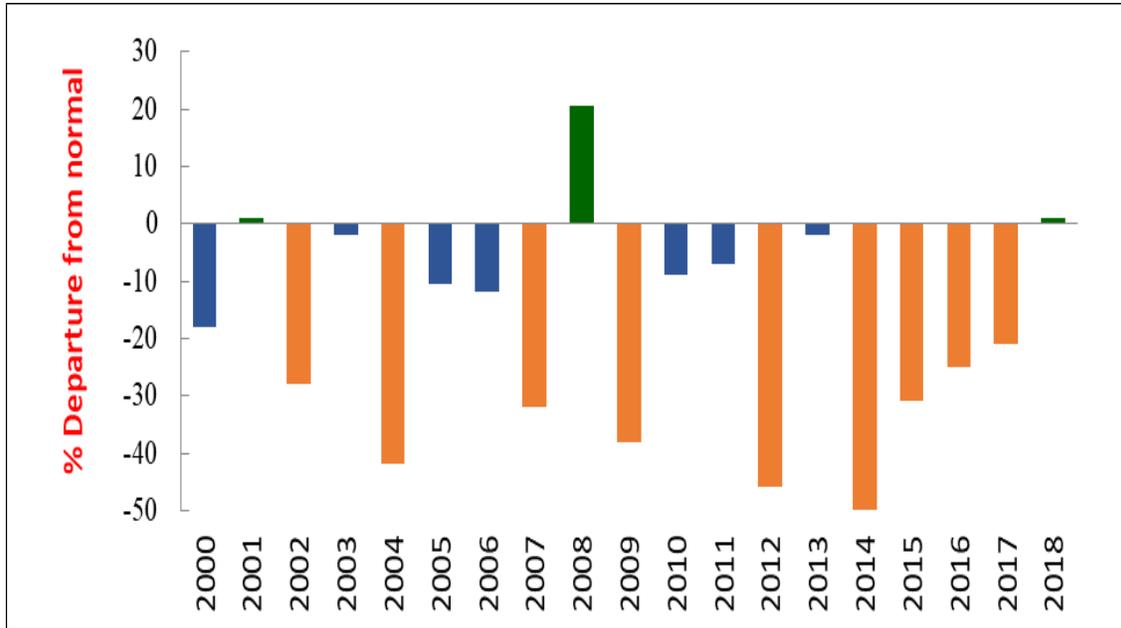
\* Ordinance/Act was issued in 2008/2009 that made it mandatory for the farmers not to seed rice nursery before 10<sup>th</sup> May and its' transplanting only after 10<sup>th</sup> June.

Source: Department of Soil Water and Engineering, PAU, Ludhiana

Table 1 shows the average decline in water table for the years 2000 to 2008 was very high at 84 cm. It was checked to some extent after the regulation of 2008/2009, however, low monsoon rainfall under the ongoing climate change scenario did not favour a more positive impact of this regulation.

**Decline in monsoon rainfall:** Figure 1 reveals that there is deficit in monsoon rainfall since 2000. It is seen that out of last 19 years, only three years had above normal monsoon, whereas eight years experienced more than 20 per cent deficit and three years more than 40

percent deficit monsoon rainfall. Thus, the phenomenon of climate change has aggravated the groundwater depletion and further shifting in transplanting date as well reduction in crop duration were necessary.



**Fig 1: Rainfall during monsoon season from 2000 to 2018 in Punjab**

Source: Department of Agrometeorology and Climate Change, PAU, Ludhiana

**Development of short duration varieties:** Short duration non-Basmati rice varieties like PR 121 (2013), PR 124 (2015) and PR 126 (2017) which mature in 110, 105 and 93 days after transplanting, respectively, have been developed at PAU, Ludhiana. These varieties are 3-4 weeks earlier in maturity than the previously pre-dominant and the presently being phased out long duration varieties (Pusa 44 and PR 118 which took about 130 days after transplanting). For maximizing productivity of the newly developed varieties, matching production technologies have also been developed. For instance the optimum seedling age at transplanting, fertilizer application schedule and transplanting date have been standardized to ensure that saving in irrigation water is not at the cost of productivity and farmers’ profit (Table 2).

**Table 2: Saving in inputs/cost by PAU recommended paddy varieties over Pusa 44**

Particulars	PR 126	PR 121
No. of days saved	37	20
Fertilizer saved (Rs per acre)	306	249
Pesticides saved (Rs per acre)	1411	1138
Irrigations saved (No.)	9	5
Labour saved (Rs per acre)	1040	720
Total variable costs saved (Rs per acre)	4151	2981
<b>Net profit (Rs per acre)</b>	<b>+176</b>	<b>+278</b>

Source: Progressive farming- A monthly magazine of PAU, Ludhiana (May 2018)

**Short duration varieties enabled further shift in transplanting date:** In the light of availability and adoption of these technologies, the act was amended further in 2014, postponing the sowing/transplanting cut off to 15 May/15 June. Creditably, Punjab farmers have showed good compliance. During *Kharif* 2012, in the non-Basmati category, 39.0 percent area was under late maturing variety Pusa 44 and 33.0 percent under PR varieties. Owing to the release of short duration, high yielding, disease resistant and better milling quality characteristics of PR varieties viz. PR 121 and PR 122 (2013), PR 123 (2014), PR 124 (2015) and PR 126 (2016), the area under short duration varieties increased to 81.9 percent during 2018. PR 121 has emerged as the most popular variety among the farmers due to its yield stability across environments. It matures in 110 days after transplanting and possesses good grain quality and less biomass. During *Kharif* 2018, it was cultivated on an area of more than 7.0 lakh ha (32.0%), PR 126 occupied an area of 16 percent whereas the area under long duration variety, Pusa 44 decreased to 17.7 percent.

**Impact of adoption of short duration varieties:** During *Kharif* 2009-10, Punjab contributed a record 92.8 lakh tonnes of rice to the central pool. Due to the increase in area under new 'PR' varieties, there was a bumper rice production in Punjab during 2015 and 2016, as a result Punjab made record contributions of 93.5 and 110.52 lakh tons of rice to the central pool during 2015 and 2016 respectively. During 2017, Punjab contributed an all-time high of 118.3 lakh tones to the central pool (Table 3). Thus, in terms of productivity shifting of transplanting date to 15<sup>th</sup> June had positive impact. In terms of water resources this shift has definitely contributed in spite of deficit rainfall for four consecutive years (2014-17).

**Table 3: Area, production, productivity of paddy, contribution to central pool and area under short duration varieties in Punjab over years**

Year	2012	2013	2014	2015	2016	2017	2018
Area (lakh ha)	28.49	28.49	28.95	29.70	30.46	30.65	31.03
Production (Lakh ton)	170.8	168.9	166.7	177.1	189.6	199.7	191.4
Productivity (kg/ha)	5997	5928	5757	5963	6224	6516	6167
Contribution of rice to central pool (lakh ton)	85.6	81.1	77.9	93.5	110.5	118.3	113.4
Area under short duration varieties (%)	32.6	37.6	41.9	54.2	66.6	74.6	81.9

Source: Booklet on Statistics of Punjab Agriculture, PAU, Ludhiana

**Shifting of transplanting date from June 15<sup>th</sup> to June 20<sup>th</sup>:** During the recent years, still shorter duration varieties became available, offering the opportunity of shifting the transplanting start date further close to monsoon onset. The experiments on date of transplanting also showed higher yield under 25<sup>th</sup> June transplanting as compared to 15<sup>th</sup> June transplanting (Table 4 and 5).

**Table 4: Yield performance of rice varieties under different dates of rice transplanting**

Date of transplanting	Varieties				Irrigation water applied (cm)
	PR 121*	PR 122**	PR 124***	PR 126****	Mean of PR 121,122,126
15 June	7925	7860	6217	7023	130.1
25 June	8279	7902	6279	7963	121.1
5 July	7522	7842	5879	8006	108.8

\*Average of six years (2013 - 2018); \*\*Average of 2013, 2016, 2017; \*\*\*Average of four years (2013 – 2016);

\*\*\*\* Average of 2016- 2017

Source: Department of Plant Breeding & Genetics and Agronomy, PAU, Ludhiana

**Table 5: Yield performance of rice varieties under different dates of rice transplanting during 2018**

Date of transplanting	PR 121	PR 126
20 June	8190	7570
27 June	8330	7770
5 July	7710	7720

Source: Department of Plant Breeding & Genetics, PAU, Ludhiana

Hence, transplanting date was revised to 20<sup>th</sup> June in 2018. The *Kharif* 2018 was thus the first season under this regulation. Unfortunately during *Kharif* 2018, rare weather anomalies i.e reduction in sunshine hours due to cloudy weather during vegetative phase along with sharp dip in maximum temperature during grain filling period of rice crop due to heavy rainfall (September 22 to 24) during the season resulted in significant yield drop, mostly in the range of 2.5 – 7.5 q/ha as compared to year 2017. A second issue relates to delay in ripening and high grain moisture. Importantly, both the trends were observed across varieties, regions and sowing dates with minor variations. It is important to note that similar yield reduction was also observed in areas, where early transplanting is allowed. Data from farmers’ fields from eight villages in Muktsar Sahib transplanted on early dates, i.e. between 10-20 June, 2018 also gave lower yield than that obtained during *Kharif* 2017, thereby, indicating that the yield reduction is across the transplanting dates. Moreover, there are also reports of yield reduction from our neighbouring state, Haryana, where transplanting start date was June 15. This clearly demonstrates that the yield reduction may be attributed to the specific weather conditions in the year 2018 rather than the date of transplanting.

**Window of operations between harvesting of rice and sowing of wheat:** Some studies have indicated that smaller window due to late transplanting may lead to concentration of burning events in short span of time (Balwinder-Singh *et al*, 2019). Sufficient window however, can be maintained even under transplanting from 20<sup>h</sup> June by adopting short duration varieties (Table 6).

**Table 6: Approximate window period for sowing of wheat after harvesting rice of different rice varieties**

Variety	Recommended transplanting time	Days to maturity (after transplanting 30 days nursery)	Window period between harvesting of rice to wheat sowing*(days)
PR 126	25 June -5 July	93	28 to 40 days
PR 124	25-30 June	105	22 to 27 days
PR 121	20-25 June	110	22 to 27 days
Pusa 44#	20-30 June#	130	0 to 5 days

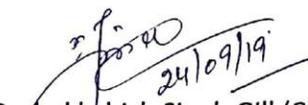
\*Sowing of wheat up to 5 November, #Long duration variety grown by some farmers

Source: Department of Plant Breeding & Genetics, PAU, Ludhiana

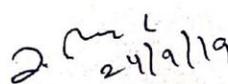
The technologies like Super SMS, Happy Seeder and other machinery for *in-situ* and *ex-situ* straw management are available and are being promoted. There has been good adoption of these machines. The paddy straw burning which was on an area of 21.34 lakh ha during 2016 came down to 19.97 and 17.80 lakh ha in 2017 and 2018 respectively. Some of this area is likely to represent partial burning only as Air quality Index (AQI) improved by 50.1% in 2018 as compared to 2017. The AQI category improved from 'poor' (201 to 300) to 'moderate' (101-200) during this period. Thus, the narrow window of time between two crops should not be a serious issue.

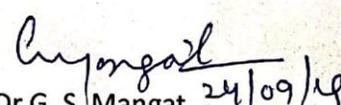
**Conclusions:**

1. Availability of short duration varieties provides the means for availing water saving benefits of transplanting from June 20<sup>th</sup> onwards.
2. Further, straw burning issue is also resolved due to availability of straw management technologies which allows for retention/incorporation/removal of straw without resorting to burning.
3. Thus shifting of transplanting date to 20<sup>th</sup> June would help save groundwater resources and would not add to air pollution due to stubble burning.

  
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