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***Short Communication***

# Estimation of crop coefficient for rice and wheat crops at Ludhiana

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Rice-wheat system is the most important and largest production system in India. Increase in cropped as well as irrigated area coupled with high cropping intensity and a major shift towards rice-wheat culture has led to over-exploitation of ground water resulting in declining ground water resources. The rapidly depleting water resources and agro-environmental health threaten the sustenance of existing levels of agricultural production and call for efficient use of water over space and time. The best applicable strategy to optimize water use on large scale is achieved through spatially explicit and accurate estimates of crop water demand and supply in a region. In FAO-56 approach, evapotranspiration (ET) is calculated by combining reference evapotranspiration (ETo) and crop coefficient (Kc). Many works have been done to estimate Kc experimentally for many crops (Doorenbos and Pruitt 1977; Snyder *et al.* 1987; Jensen *et al*, 1990; Allen *et al.* 1998).Doorenbos and Pruitt (1977) have outlined the procedure for determining the crop coefficient at different stages of the crop growth. They have given crop coefficient of each crop at three major crop stages, namely initial stage, mid season stage and late season stage which may however vary with the date of sowing.The crop coefficients have been corrected for local conditions to determine the water requirement of different crops in Gujarat (Mehta and Pandey 2015; 2016)

In Punjab rice was transplanted at the end of May, but now transplanting is shifted to June. So the shifting in transplanting date, crop coefficient will vary. Therefore, the present study was undertaken to estimate the (near) real time spatially distributed crop coefficient for rice and wheat crops under different dates of sowings i.e. early, normal and late sowings based on crop coefficient approach. The study was carried out at School of Climate Change and Agricultural Meteorology, Punjab Agricultural University, Ludhiana ($75^0$ 52' E longitude, $30^0$ 56' N latitude and 247 mm altitude above sea level) Punjab, India. The historical meteorological daily data (1971-2014) on rainfall, maximum and minimum temperature, relative humidity and wind speed was taken from the meteorological observatory situated in the research farm at PAU, Ludhiana.

The description of the rice and wheat crops showing the length of growing season, length of the four crop development stages and the crop coefficient (Kc) values at initial, mid- season and late season stages are given in Table 1.

***Crop coefficient (Kc) for rice crop***

The length of different stages of rice was found to vary with dates of sowing. However, the duration of crop was found to generally decrease with delayed sowing (Table 1). The crop coefficients during initial stage was found to be same (1.15) under all the sowing dates. Kc values for mid season stage was 1.36 under all the sowings during May however, it was 1.26 for June 6 sowing rice crop. Similar to mid season Kc value, the end season Kc value was 0.86 for May sowing rice and 0.76 for June 6 sowing rice crops.

***Crop coefficient (Kc) for wheat crop***

The duration of different crop stages of wheat were also found to vary with dates of sowing (Table 1). The total crop duration was found to decrease with delay in sowing and varied from 146 days in October 28 sown wheat to 127 days in December 2 sown crop. The Kc values for initial stage was found to increase with delay in sowing (0.39 to 0.55) while in mid season stage Kc was found to decrease from 1.26 to 1.17 with delay in sowing. Similar decreasing trend was also observed during end season stage (Table 1).

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**Table1:** Crop duration and crop coefficient values during different stages for rice and wheat crops

| Dates of sowing | Crop duration | | | | Length of growing season | Crop coefficient (Kc) | | |
|---|---|---|---|---|---|---|---|---|
| | Initial stage | Developing stage | Mid season stage | End season stage | | Initial stage | Mid season stage | End season stage |
| | | | | **Rice** | | | | |
| 6th May | 31 | 39 | 51 | 19 | 140 | 1.15 | 1.36 | 0.86 |
| 16th May | 31 | 36 | 44 | 11 | 122 | 1.15 | 1.36 | 0.86 |
| 26th May | 31 | 45 | 42 | 20 | 138 | 1.15 | 1.36 | 0.86 |
| 6th June | 30 | 41 | 43 | 15 | 129 | 1.15 | 1.26 | 0.76 |
| | | | | **Wheat** | | | | |
| 28th Oct | 25 | 41 | 51 | 29 | 146 | 0.39 | 1.26 | 0.36 |
| 4th Nov | 23 | 46 | 43 | 32 | 144 | 0.46 | 1.20 | 0.30 |
| 25th Nov | 25 | 45 | 35 | 28 | 133 | 0.46 | 1.20 | 0.30 |
| 2nd Dec | 29 | 40 | 30 | 27 | 127 | 0.55 | 1.17 | 0.26 |

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