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Phenological Studies on Five Maize Hybrids under Higher Nitrogen Levels in Western Zone of Tamil Nadu

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Field experiments to study the influence of increased nitrogen fertilizer application on phenological parameters in five maize hybrids were conducted in the experimental field at Eastern Block of Tamil Nadu Agricultural University, Coimbatore during *kharif* and *rabi*, 2012. The experiment was laid in strip plot design and the factors were five maize hybrids in main plot (CMH 08 - 282, CMH 08 – 337, CMH 08 – 350, NK 6240, 900 M Gold) and four nitrogen levels 135 (100%), 155.25 (115%), 175.50 (130%) and 195.75 (145%) kg N ha^{-1} in sub plot. The results revealed that maize hybrids and nitrogen levels influenced the phenological parameters of all the maize hybrids in both the seasons. The occurrence of 50 % tasseling and physiological maturity were slower under higher nitrogen dose (195.75 kg N ha^{-1}) than lower nitrogen level (135 kg N ha^{-1}). Number of grains per cob was higher with higher nitrogen application in both the seasons in NK 6240 and lower in the same hybrid at lesser nitrogen dose.

Key words: Maize, Tasseling, Physiological maturity, Nitrogen.

The study of phenology is one of the most important factor that determines the crop growth and development of any crop and is essential to acquire knowledge on the physiological response of the crop under different field conditions (Summerfield *et al.*, 1991). The phenology of the crop is influenced by parameters like the crop genotype, nutrient, biotic, abiotic and weather parameters. The study of phenological characters would help to select varieties, time of application of nutrients, irrigation practices and other management practices.

Maize phenology is a function of genotype, temperature and photoperiod, as well as influenced by nitrogen, varieties and moisture (Wallance and Yan, 1998; Hodges, 1991; Kiniry and Bonhemme, 1991). The influence of N on maize phenology had earlier been reported by Ogunlela *et al*. (1988) and Dass *et al*. (1997). The factors like temperature and photoperiod cannot be modified in a relatively large scale, but the parameters like irrigation, nutrient, *etc*., can be modified even at micro level, which aids the maize farmers to modify the phenology while carrying out the normal agronomic practices (Wallance and Yan, 1998). Considering the possible modification in crop phenology by external outputs, a study was undertaken to understand the effect of nitrogen in five maize hybrids in influencing the maize phenological parameters *viz.,* 50% tasseling, days to physiological maturity and grain number per cob.

Materials and Methods

Field experiments were conducted at the Eastern Block Farm (11° 0' N and 76° 56' E) of Tamil Nadu Agricultural University, Coimbatore, India during 2012. The soil type was clay loam with a pH of 8.3. The experiment was laid in a strip plot design with three replications. In the main plot five hybrids [CMH 08–282, CMH 08–337, CMH 08–350, NK 6240 (Syngenta), 900 M Gold (Monsanto)] were evaluated and in the sub plot four levels of nitrogen [135 (100%), 155.25 (115%), 175.50 (130%) and 195.75 (145%) kg N ha^{-1})] were fitted. The phosphorous and potassium fertilizers were applied as per the recommendation (62.5 and 50 kg ha^{-1}, respectively). The nitrogen fertilizer as urea was applied in three splits in the ratio of 25:50:25 per cent at basal, 25 and 45 DAS, respectively. Phosphorous (Single super phosphate) was applied as 100 per cent basal and potassium fertilizer (Murate of potash), at basal and 45 DAS in two equal splits. All other crop management practices were followed as recommended by Tamil Nadu Agricultural University (TNAU), India. The spacing between the rows and plants were 0.6 and 0.25 meters, respectively (66,667 plants ha^{-1}). The crop was sown during June 2012 (*kharif*) and December 2012 (*rabi*). Monthly average of the weather parameters prevailed during the cropping period are given in Table 1. Regression analysis was worked out to know the relationship between the nitrogen level and phenological parameters of the maize hybrids tested.

Results and Discussion

Days to 50% tasseling was influenced by different doses of nitrogen, the relationship shows R^2values more than 0.8 in *kharif* and *rabi* except for

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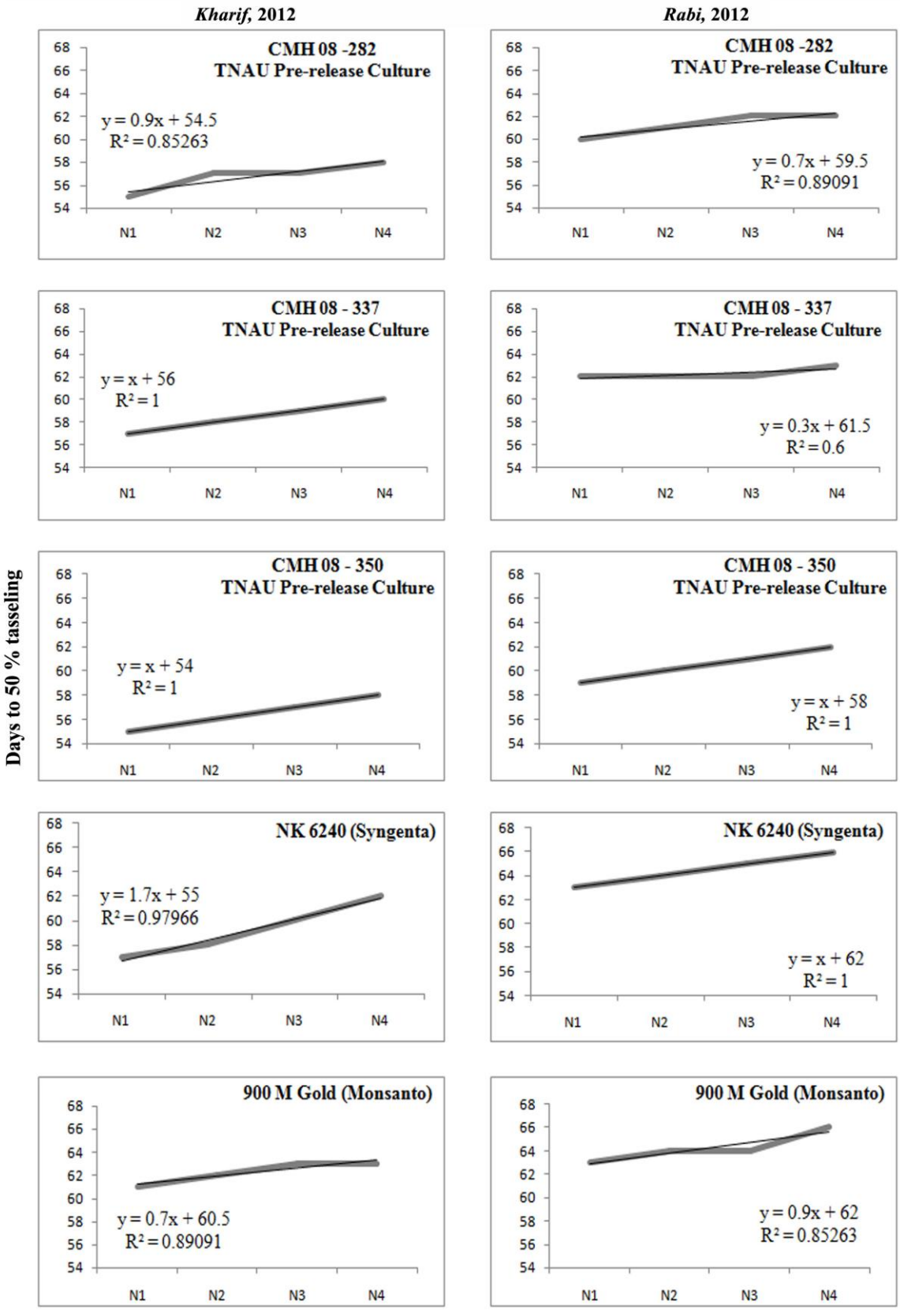
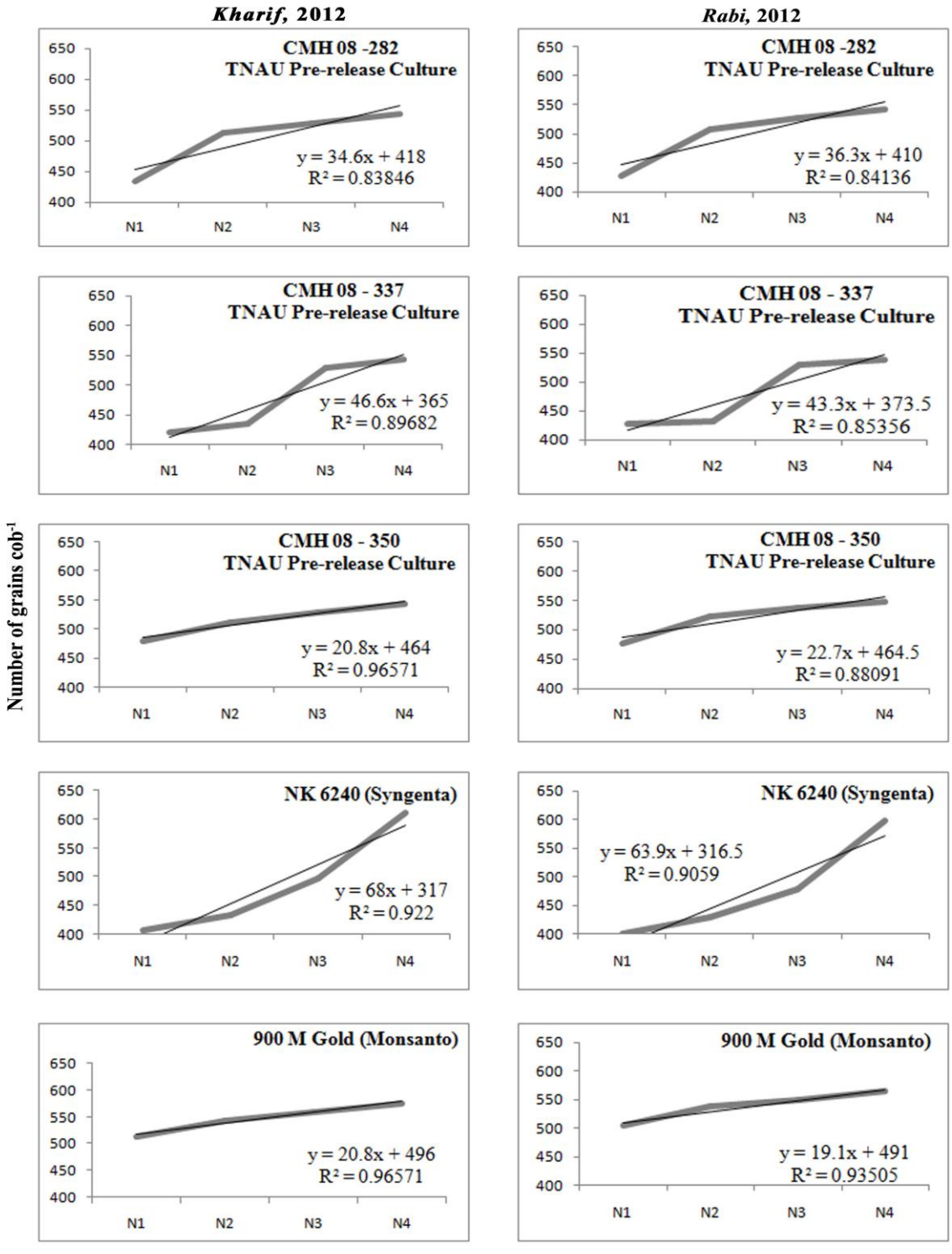
Fig. 1. Days to 50% tasseling of five maize hybrids during *Kharif* and *Rabi*, 2012



CMH 08 – 337 (R^2=0.6) in *rabi* season. In all the hybrids the increased level of N delayed the 50% tasseling time by 3 to 5 days. The hybrid NK 6240 showed a perfect relation in both seasons, where $R^2$was 1. This result clearly indicated the effect of nitrogen levels on the 50% tasseling time though the hybrids exhibited difference among themselves (Fig. 1). The findings of Hokmalipour (2010), who reported that application of increased nitrogen delayed the date of appearance of the crown flower in maize is in concomitant to the present finding. In general, the days to 50% tasseling was earlier in *kharif* than the *rabi* season and this was due to the effect of photoperiod on growth of the crop.

Fig. 2. Number of grains cob^{-1} of five maize hybrids during *Kharif* and *Rabi*, 2012



Physiological maturity of the five hybrids varied with higher nitrogen levels in both the seasons. In general, increased level of N delayed the physiological maturity and it was earlier in *kharif* than the *rabi* season. Though, the days to physiological maturity vary in both the seasons

Table 1. Monthly average of the weather parameters during maize cropping season.

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	RF (mm)	SR (Cal/cm2)
Jun-12	32.39	23.75	11.1	368.1
Jul-12	31.50	23.51	27.5	353.2
Aug-12	31.22	23.01	28.3	323.1
Sep-12	32.41	22.58	6.1	360.5
Oct-12	30.63	22.31	165.2	313.3
Nov-12	30.72	20.52	22.4	382.1
Dec-12	30.48	20.33	6.9	383.5
Jan-13	31.57	19.00	0.0	429.0
Feb-13	31.94	20.68	99.8	398.8
Mar-13	34.16	22.76	0.0	403.1

(Table 2), there existed a strong relationship as indicated by high R^2values, which were above 0.85 in all the hybrids tested. These results are in concurrence with the findings of Shrestha (2013) who reported similar result under five levels of nitrogen tested in maize.

Table 2. Effect of higher nitrogen levels on physiological maturity (days) in five maize hybrids in *kharif* and *rabi*, 2012

	Kharif, 2012					Rabi, 2012				
	CMH 08 - 282	CMH 08 - 337	CMH 08 - 350	NK 6240	900 M Gold	CMH 08 - 282	CMH 08 - 337	CMH 08 - 350	NK 6240	900 M Gold
N_1-135 (100%)	87	88	87	87	92	96	98	95	96	99
N_2-155.25 (115%)	90	91	89	89	94	98	98	96	98	101
N_3-175.50 (130%)	91	92	90	93	96	99	99	98	100	101
N_4-195.75 (145%)	94	94	92	95	96	100	101	100	103	104
R_2	0.96	0.96	0.98	0.98	0.89	0.96	0.83	0.97	0.98	0.88

The higher nitrogen level had the highest number of grains per cob invariably in all the hybrids tested under both *kharif* and *rabi* seasons (Fig. 2). Hokmalipour (2010) also obtained similar results, where the number of grains per cob increased as the result of application of higher nitrogen dose. The highest number of grains per cob was observed in NK 6240, 612 and 597 under higher nitrogen level (195.75 kg N ha^{-1}) in both *kharif* and *rabi* seasons, respectively.

Conclusion

Application of higher nitrogen influenced the vital phenological parameters of the crop in spite of difference in the genotypes and seasons. The higher nitrogen level delayed the vegetative growth period and resulted in late production of tasseling and physiological maturity. The number of grains per cob increased with the increase in the nitrogen level for the different genotypes and seasons studied. Hence, it could be concluded that the response of maize hybrids to high levels of nitrogen in increasing yield parameter be exploited for achieving improved yields.

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