VOL. 1, NO. 4, NOVEMBER 2006 ISSN 1990-6145
Journal of Agricultural and Biological Science

www.arpnjournals.com

BERSEEM (*TRIFOLIUM ALEXANDRINUM L*) AND SHAFTAL (*T RESUPINATUM L*) AFTER VARIOUS CUTS, BIOMASS INCORPORATION AT FINAL HARVEST SUPPLEMENT WITH NITROGEN, IMPACT ON THE TASSELING AND SILKING COINCIDENCENESS, DAYS DIFFERENCES FROM TASSELING TO SILKING AND GRAIN FILL DURATION OF MAIZE

Habib Akbar[1], Mohammad Tariq Jan[1], Amanullah Jan[1], Zahir Shah[2], Muhammad Idrees[1]
[1]Department of Agronomy, NWFP Agricultural University, Peshawar, Pakistan
[2]Department of Soil and Environmental Sciences, NWFP Agricultural University, Peshawar, Pakistan
E-mail: aup_idrees@yahoo.com

ABSTRACT

Two years average results indicated that maximum gap of six days were observed from tasseling to silking. After zero, single and two cuts showed coincidenceness for cob silks and tassel pollen, phenological developments. Maximum grain filling of 43 days were recorded from fallow, shaftal after three cuts and berseem without cut as well. Interactive effect of legumes cutting and N affected grain filling duration. Days gaps between tasselings and silking were lessened for maximum grain fill days. Coincidenceness of inflorescences, tasseling and silking has left beneficial impact on later yield components. The conclusions drawn from the entire research were, as Coincidence and less days differences between tasselling and silking increased grain fill duration, fertilized competent ovules in maize. Organic, unpredicted to be mineralized at need stage and inorganic readily usable form, application both are equally essential under uncertainties for phenological coincidenceness.

Keywords: berseem, shaftal, maize, tasseling, silking, grain.

INTRODUCTION

Tasseling is ahead of silking. As tasseling occurred and silking delayed, concidenceness is lost and results in vegetative tassel.Pollen viability lost. Synchronization leads to yield.

Martiniello *et al*. (1996) concluded that dry matter partitioning in the leaf, stem, root and seed production of three berseem populations under cutting regimes (at 4th, 8th node elongation at early flowering and physiological maturity of seed. At early flowering cut root DM plant^{-1} was high. Cuts applied early in plant development depleted root reserves causing plant death. Ritichie and Hanway (1982) described that vegetative tasseling, in maize the last apical branch of the tassel is completely visible but the silks have not emerged yet about 2-3 days before silk emergence. Plants are almost at full height.Wiegand and Cuellar (1981) concluded that 3.1 days shortening of grain filling per degree C increase in mainly daily air temperature during grain filling compares with 2.8 days C^{-1}, kernel weight decreased 2.8mg kernel^{-1} C^{-1} compared with 1.5 mg for each degree of C increase in temperature summing up that temperature is pacing plant senescence and that shortening the duration of grain filling is its common manifestation in commercial and spring wheat's temperature when in excess of about 15 C explains the dependence of 1000 kernel weight on grain filling duration.

MATERIALS AND METHODS

An experiment entitled "Carry over effects of crop management techniques and nitrogen on the yield of subsequent crop" was conducted at Agricultural Research Farm, NWFP Agricultural University, Peshawar. The Experimental treatments were carried out in Randomized Complete Block (RCB) design with a split plot arrangements having four replications for two consecutive years (1999/2000 and 2000/2001). Each year, experiment was conducted in two phases. Phase-I was designated to the cropping management techniques berseem, shaftal and their cuts as pre-requisite for the phase-II. In phase-II, the residual effect of the phase-I as well as fertilizer-N with various N levels i.e. 0, 40, 80 and 120kg N ha^{-1} were studied. In phase-I, bigger plots were established for various cropping techniques, numbering in eleven per replication. Similarly, each plot of phase-I was further divided into sub-plots in phase-II. Four levels of fertilizer-N were randomly distributed in these sub-plots, making total number of forty four treatments in phase-II. A uniform basal dose of NPK (50-100-100) kg ha^{-1} was applied to cereals and 0-100-100 kg ha^{-1} to legumes in phase-I.

Phase-I

In this phase, two legumes with various cutting frequencies, two cereals and a fallow treatment were established. Details of the treatments are as under:

S. #	Treatment	Remarks
1.	**BH_O** (Berseem with no cut)	Berseem was grown and no cut was given to the crop in the entire growing season. At maturity (before phase-II), the whole crop was harvested and incorporated into the soil.

2.	**BH_1** (Berseem with single cut)	Only one cut was given to the crop in whole growing season. After single cut the crop was left to grow till maturity and incorporated into the soil at the end of the season.
3.	**BH_2** (Berseem with two cuts)	Two cuts were given to the crop and left till maturity. At the end of season, the whole crop was incorporated into the soil.
4.	**BH_3** (Berseem with three cuts)	Three cuts were taken from the crop. At the end of season, entire crop was incorporated into the soil.
5.	**SH_0** (Shaftal with no cut)	Shaftal was grown and no cut was given to the crop in the entire growing season. At maturity (before phase-II) the whole crop was harvested and incorporated into the soil.
6.	**SH_1** (Shaftal with one cut)	Only one cut was given to the crop in whole growing season. After single cut the crop was left to grow till maturity and incorporated into the soil at the end of the season.
7.	**SH_2** (Shaftal with two cuts)	Two cuts were given to the crop and left till maturity. At the end of season, the whole crop was incorporated into the soil.
8.	**SH_3** (Shaftal with three cuts)	Three cuts were taken from the crop. At the end of season, entire crop was incorporated into the soil.
9.	**Wheat**	Wheat was grown. At physiological maturity, the entire crop was harvested and taken away, no residue was incorporated into the soil.
10.	**Barley**	Barley was grown. At physiological maturity, the entire crop was harvested and taken away, no residue was incorporated into the soil.
11.	**Fallow**	Field was kept fallow for the whole growing season in phase-I only.

Sowing of phase-I was practiced on same date for uniformity. Legume incorporation at final harvest was also done on same date for various numbers of cuts. Both, berseem and shaftal dry herbage yield at various cuts were recorded to estimate the seasonal herbage yield from various cropping management for clovers. Similarly the herbage yield at final harvest was recorded for the estimation of the quantity of crop residue which has been incorporated prior to phase-II.

Phase-II

The major experiments were conducted in phase-II during 2000 and 2001. Maize was sown as a subsequent crop to understand the residual effect of the preceding crops management techniques. Four fertilizer N levels i.e. 0, 40, 80 and 120 kg ha^{-1}, were added additionally to the experimental units at phase-II. The crop management techniques (established in phase-I) were designated as main plots while N levels were randomly distributed as sub-plots treatments. Data on various parameters were taken according to the outlined procedure.

Days differences between Tasselling to Silking and Grain Filling Duration (days)

The data of 50% tasselling early was subtracted from data of silking during each year. Grain filling duration was calculated by substracting data of silking from physiological maturity.

Statistical analysis

The collected data was statistically analyzed according to the appropriate method (Steel and Torrie, 1980). F-test was used to detect the significance of treatments' effect and LSD was used as a test of significance at 0.05% level of probability. ANOVA was further split to understand and compare the means in detail for which meaningful contrast were done.

RESULTS AND DISCUSSION

The data collected on dry biomass (kg ha^{-1}) of legumes at final harvest (incorporated) during phase-I (1st and 2nd year) is presented in Table-1. The statistical analysis of the data showed that significant differences were observed for dried biomass in legumes at final harvest for both years.

Table-1. Dry biomass (kg ha^{-1}) of legumes at final harvest (incorporated) during phase-I (1st and 2nd year).

Treatment	1999-2000	2000-01
BH_0	6413 ab	5788 ab
BH_1	7562 a	6063 a
BH_2	6600 a	6913 a
BH_3	7513 a	7600 a
SH_0	2752 c	4250 b
SH_1	3875 bc	3538 b
SH_2	2450 c	6200 a
SH_3	2050 c	4500 b
$LSD_{(0.05)}$	2992	2870
Berseem	7022 a	6591 a
Shaftal	2407 b	4622 b

Regardless of the number of cuts, generally berseem produced significantly higher herbage yield at final harvest than shaftal during both years. On average berseem produced 7022 and 6591kg ha^{-1} of dried herbage during 1st and 2nd year, respectively while shaftal produced 2407 and 4622kg ha^{-1} of herbage at final harvest during 1st and 2nd year, respectively.

Days differences between tasseling and silking

Two years average results for maize days differences between tasselling and silking as affected by cropping management techniques and fertilizer N-application is presented in Table-2 (a, b, c and d).

Table-2a. Effects of crop management and fertilizer-N application on days differences between tasseling and silking of maize during 2000-2001.

Treatment	Year-I	Year-II	Average
BH_O	4 b	6 b	5 b
BH_1	4 b	6 b	5 b
BH_2	4 b	7 a	5 b
BH_3	4 b	4 d	4 c
SH_0	4 b	6 b	5 b
SH_1	3 c	6 b	5 b
SH_2	4 b	7 a	6 a
SH_3	4 b	5 c	4 c
Wheat	4 b	7 a	6 a
Barley	4 b	6 b	5 b
Fallow	5 a	5 c	5 b
$LSD_{(0.05)}$	0.67	0.78	0.50

Table-2b. Effects of crop management and fertilizer-N application on days differences between tasseling and silking of maize during 2000.

	Kg N ha^{-1}				
	0	**40**	**80**	**120**	**Mean**
Legume		**L x N**			
Berseem	5	4	4	3	4
Shaftal	5	3	3	4	4
Harvest		**H x N**			
H_0	6	4	3	3	4 a
H_1	4	3	3	3	3 b
H_2	6	3	3	4	4 a
H_3	5	3	3	3	4 a
Mean (N)	5 a	4 b	4 b	3 c	

$LSD_{(0.05)}$ for Harvest = 0.47
$LSD_{(0.05)}$ for Nitrogen = 0.32
$LSD_{(0.05)}$ for legume = ns
$LSD_{(0.05)}$ for L x N = **
$LSD_{(0.05)}$ for H x N = *

Table-2c. Effects of crop management and fertilizer-N application on days differences between tasseling and silking of maize during 2001.

	Kg N ha^{-1}				
	0	**40**	**80**	**120**	**Mean**
Legume		**L x N**			
Berseem	6	6	6	5	6
Shaftal	6	6	6	6	6
Harvest		**H x N**			
H_0	5	6	5	7	6 b
H_1	7	7	6	5	6 b
H_2	7	7	7	6	7 a
H_3	4	4	4	5	4 c
Mean (N)	6 a	6 a	5 b	5 b	

$LSD_{(0.05)}$ for Harvest = 0.55
$LSD_{(0.05)}$ for Nitrogen = 0.41
$LSD_{(0.05)}$ for legume = ns
$LSD_{(0.05)}$ for L x N = ns
$LSD_{(0.05)}$ for H x N = **

Table-2d. Two years average for the effect of crop management and fertilizer-N application on days differences between tasseling and silking of maize.

Kg N ha^{-1}					
	0	**40**	**80**	**120**	**Mean**
Two years average					
Legume	**L x N**				
Berseem	6	5	5	4	5
Shaftal	6	5	4	5	5
Harvest	**H x N**				
H_0	6	5	4	5	4.94 ab
H_1	6	5	5	4	4.78 b
H_2	6	5	5	5	5.33 a
H_3	5	4	4	4	4.05 c
Mean (N)	6 a	5 b	5 b	4 c	

$LSD_{(0.05)}$ for Year = **
$LSD_{(0.05)}$ for Harvest = 0.36
$LSD_{(0.05)}$ for Nitrogen = 0.26
$LSD_{(0.05)}$ for Legume = ns
$LSD_{(0.05)}$ for Y x N = **
$LSD_{(0.05)}$ for L x N = *
$LSD_{(0.05)}$ for H x N = **
$LSD_{(0.05)}$ for Y x T x N = **

Means followed by different letters in the same category are significantly different at 0.05 level of probability.
*, ** = Significant at 0.05 and 0.01 level of probability, respectively.
n s = non-significant.

The statistical analysis of the data (Table-3) showed highly significant differences for days differences between tasselling and silking. Fallow vs cropped followed by maize showed non-significant means differences. Legume vs cereals wheat vs barley followed with subsequent maize indicated significant means differences. Irrespective of legumes, N, cutting techniques were found significant (legume x N) (cuts x N) followed maize showed significant and highly significant means differences for days between tasselling and silking. Statistical analysis for N showed significant means differences irrespective of legume species and cutting techniques. Two years average results indicated that after tasselling to silking delayed up to 6 days. Minimum 4 days were observed when maize was planted on shaftal, after taking 3 cuts. Number of days between tasselling and silking or (silking followed tasselling) were increased up to 5 days. Under maximum days, gap is widened against the coincidenceness. Among planned comparisons of means maize planted on fallow vs cropped showed equal number of days (4.6, 4.9 or 5) non-significantly different. Maize planted on legume plots vs cereal showed significant gap silking after tasselling i.e. (5.6, 4.9 or 6, 1) significantly different.

Table-3. Planned comparisons of means with statistical significance.

Fallow vs.	4.7**	4.5**	4.6ns
Cropped	3.9	5.9	4.9
Legume vs.	3.8**	5.7**	4.8**
Cereal	4.2	6.3	5.3
Wheat vs.	4.3ns	6.9**	5.6**
Barley	4.1	5.8	4.9

After zero, 1, 2 cuts days differences between silking followed tasselling were zero. Differences between tasselling and silking were 4 days when maize was cropped on irrespective of legume after taking three cuts. Among the harvest only 1-day difference was observed. Interactive effect of (legume x N) and cuts at final harvest (H x N) were found significant and highly significant. Nitrogen @ 120 kg ha^{-1} had significantly reduced days differences silking after tasselling up to (4) days. With decrease in N 80, 40-kg ha^{-1} days differences were same or increased up to (5) days. Under unfertilized situation irrespective of legume species, and cutting management gap increased between tasseling to silking up to (6) days.

Low, 0, 40 kg N ha^{-1} delayed tasseling from (53-54) days. High N i.e. 80-120 kg ha^{-1} did not increased maize days to 50% tasseling. The reason may be that low N delayed tasseling and high N dose shorten tasselling time. The tasselling period decreased with increased N rate (Gokmen *et al*. 2001). Low N delay phenological, (timing of different vegetative and reproductive (staminate and pistillate inflorescence (↑, $+^0$ essential floral parts) growth stages of a crop in relation to time or calendar days. Temperature and photoperiod are the key indicators, long short maturity determinate and indeterminate nature etc.

Grain Filling Duration (days)

The grain filling duration of maize as affected by preceding cropping management techniques i.e. after berseem and shaftal no cut, single, two and three cuts (dried biomass incorporation) at final harvest, after fallow (un-cropped) for rabi season, wheat and barley (no crop residue incorporation) are presented in Table-4 (a, b, c and d), have highly significantly affected grain filling duration, when kharif maize was followed-up.

Table-4a. Effects of crop management and fertilizer-N application on grain filling duration (days) of maize during 2000-2001.

Treatment	Year-I	Year-II	Average
BH_O	47b c	36 b	42 ab
BH_1	48a b	36 b	42 ab
BH_2	48 ab	35 b	41 b
BH_3	48 ab	36 b	42 ab
SH_0	47 bc	35 b	41 b
SH_1	49 a	36 b	43 a
SH_2	47 bc	35 b	41 b
SH_3	48 ab	38 a	43 a
Wheat	46 c	35 b	41 b
Barley	47b c	35 b	41 b
Fallow	48 ab	38 a	43 a
$LSD_{(0.05)}$	1.38	1.58	1.03

Table-4b. Effects of crop management and fertilizer-N application on grain filling duration (days) of maize during 2000.

	Kg N ha^{-1}				
	0	**40**	**80**	**120**	**Mean**
Legume	**L x N**				
Berseem	45	48	49	49	48
Shaftal	45	49	49	49	48
Harvest	**H x N**				
H_0	44	48	48	48	47 b
H_1	46	48	50	49	48 a
H_2	45	48	48	48	47 b
H_3	45	49	49	49	48 a
Mean (N)	45 b	48 a	48 a	48 a	

$LSD_{(0.05)}$ for Harvest = 0.98
$LSD_{(0.05)}$ for Nitrogen = 0.65
$LSD_{(0.05)}$ for legume = ns
$LSD_{(0.05)}$ for L x N = ns
$LSD_{(0.05)}$ for H x N = ns

Table-4c. Effects of crop management and fertilizer-N application on grain filling duration (days) of maize during 2001.

	Kg N ha^{-1}				
	0	**40**	**80**	**120**	**Mean**
Legume	**L x N**				
Berseem	33	37	36	37	36
Shaftal	35	36	37	37	36

Journal of Agricultural and Biological Science

Harvest		**H x N**			
H_0	34	37	36	36	36 ab
H_1	34	36	38	38	36 ab
H_2	32	35	35	39	35 b
H_3	32	38	37	36	37 a
Mean (N)	33 c	36 b	37 a	37 a	

$LSD_{(0.05)}$ for Harvest = 1.12
$LSD_{(0.05)}$ for Nitrogen = 0.94
$LSD_{(0.05)}$ for legume = Ns
$LSD_{(0.05)}$ for L x N = Ns
$LSD_{(0.05)}$ for H x N = **

Table-4d. Two years average for the effect of crop management and fertilizer-N application on grain filling duration (days) of maize.

			Kg N ha^{-1}		
	0	**40**	**80**	**120**	**Mean**
			Two years average		
Legume		**L x N**			
Berseem	39	42	42	43	42
Shaftal	40	42	43	43	42
Harvest		**H x N**			
H_0	39	43	42	42	41 b
H_1	40	42	44	44	42 a
H_2	38	42	42	43	41 b
H_3	41	43	43	42	42 a
Mean (N)	39 c	42 b	43 a	43 a	

$LSD_{(0.05)}$ for Year = **
$LSD_{(0.05)}$ for Harvest = 0.73
$LSD_{(0.05)}$ for Nitrogen = 0.56
$LSD_{(0.05)}$ for Legume = ns
$LSD_{(0.05)}$ for Y x N = ns
$LSD_{(0.05)}$ for L x N = ns
$LSD_{(0.05)}$ for H x N = **
$LSD_{(0.05)}$ for Y x T x N = **

Means followed by different letters in the same category are significantly different at 0.05 level of probability.
*, ** = Significant at 0.05 and 0.01 level of probability, respectively.
n s = non-significant.

The statistical analysis of the data (Table-5) showed highly significant differences for maize grain filling days, when planted on rabi plots fallow vs cropped, and legumes vs cereals.

Table-5. Planned comparisons of means with statistical significance.

Fallow vs.	48 ns	38 **	43 **
Cropped	47	36	42
Legume vs.	48 ns	36 **	42 **
Cereal	46	35	41
Wheat vs.	46 ns	35 ns	41 ns
Barley	47	35	41

Legumes cutting and N effect were found significant. Legumes (cutting x nitrogen) effect was highly significant, when no cut, single, two and three cuts were implied, and last cut was incorporated into soil and maize in the season ahead was enriched with inorganic N fertilizer. Based on two years average maximum grain filling days 43 were recorded from fallow, shaftal with three cuts, berseem without cut, followed maize. Among the planned comparisons of means fallow was best 43 grain filling days were utilized as compared with cropped 42. Legumes vs cereals availed 42 and 41 days for grain filling. Among cereals followed maize were found not significant. Among legumes cuttings followed with maize maximum 42 grain filling days were availed for maize grain filling days when summer maize followed after 1 and 3 cuts dried biomass was incorporation. Interactive effect of (Legume cutting x nitrogen) was found highly significant when planted with maize maximum grain filling days 44 were utilized irrespective of legumes berseem and shaftal after taking single cut, enriched with 80 and 120kg N ha^{-1}. Minimum grain filling days (38) were achieved under N control and after taking two cuts, followed by highly exhaustive maize crop. Eighty to 120 kg N ha^{-1} had significantly increased grain filling duration 43 as compared with without N and 40kg N ha^{-1} i.e. 39 and 42 grain filling days. Kernel growth rate is influenced by environmental factors i.e. light, temperature soil moisture. Kernel growth rate ranged from 0.78 to 1.79mg $kernel^{-1}$ d^{-1}. Effective filling period dry matter accumulation and kernel fill-duration from anthesis to physiological maturity EFD i.e. 17-33 days. Assimilate utilization (AU) decreased with increasing O_3 pollution i.e. negative relationship. Kernel growth rate also depends on current photosynthesis and translocation of current and previous fixed carbon to sink kernels for storage (Bruckner and Frohberg, 1987). At no cut more dried biomass incorporation is a good criterion for availability of N to synchronize crop uptake for early development of silks. Nitrogen is essential inputs correct the ahead ontegony in crop for inflorescence development well-in time. Tasseling is ahead of silking only one day differences do affect subsequent yield components. Less N application increased day's gaps between tasseling to silking. More N decreased the gap for synchronization and coincidenceness. Early tasselling resulted in pollen dehydration, late silking make the tassel vegetative. Coincidences increased fertile competent florets, and luster ness in the later stages. Low, 0, 40kg N ha^{-1} delayed tasselling from (53-54) days. High N i.e. 80 to 120kg ha^{-1} did not increase maize days to 50% tasseling. The reason may be that low N delayed tasseling and high N dose shorten tasseling time. The tasselling period decreased with increased N rate (Gokmen *et al.* 2001). Low N delay phenological, (timing of different vegetative and reproductive (staminate and pistillate inflorescence ($\uparrow$, $+^0$ essential floral parts) growth stages of a crop in relation to time or calendar days. Temperature and photoperiod are the key indicators, long short maturity determinate and indeterminate nature etc. Cereals and more cuttings effect N removal with the same passions. Days to silking were increased or delayed silking. This showed deficiency of N because due to cuttings N is removed from herbage. From cereals N is harvested in the form of nitrogen harvest index, left the soil deficient in N below recommended level. Low nitrogen level of soil depressed essential growth for phenological development. In fallow and legumes a little bit N is build-up compensate the N deficiency because under unfertilized N plots reproductive growth is limited. At no cut more dried biomass incorporation is a good criterion for availability of N to synchronize crop uptake for early development of silks. Nitrogen is essential inputs correct the ahead ontegony in crop for inflorescence development well in time. Early tasseling resulted in pollen dehydration, late silking make the tassel vegetative. Coincidences increased fertile competent florets and lusterness in the later stages. Carboxylation efficiency, reduce CO_2 uptake, assimilates partition. Grain filling days are increased in fallow shaftal after three cuts, due to more yield contents reached to storage organ. Less filling days i.e. (42, 41) followed cereals indicated that cereals exhaust soil nitrogen (wheat more than barley) decreased vegetative reproductive growth. Due to poor reproductive growth, number of fertile ovule decreased, remained small and resulted in fewer days for grain to be filled. Due to legumes cutting (cuts x N) nitrogen is removed from soil, N is depleted so current inorganic nitrogen compensate removed N from soil in the form of herbage showed immediate response to readily available N. As a result grain filling duration was increased to 43 days. Water as yield contents carriers also expedite translocation reduces grain filling duration. Decreased photosynthesis results in low chlorophyll contents, soluble protein, reduce Kernel growth rate is influenced by environmental factors i.e. light, temperature soil moisture. Kernel growth rate ranged from 0.78 to1.79mg $kernel^{-1}$ d^{-1}. Effective filling period dry matter accumulation and kernel fill-duration from anthesis to physiological maturity EFD i.e. 17-33 days (Van Sanford, 1985).Assimilate utilization (AU) decreased with increasing O_3 pollution i.e. negative relationship. Kernel growth rate also depends on current photosynthesis and translocation of current and previous fixed carbon to sink kernels for storage (Bruckner and Frohberg, 1987). Fallow and legumes dried biomass incorporation after zero, taking single, two and three cuts increased release of nitrogen contents in soil well in time i.e. at pre-anthesis stage which synchronizes maize reproductive growth demand for potential ears. Inorganic N irrespective of legume species and their cutting techniques increased number of grains cob^{-1}. Nitrogen increased vegetative and reproductive growth. Maize is highly N responsive crop. Potential ears are increased two weeks prior to tasselling and silking. Early nitrogen either released from residue or inorganic source increased grains formation in later stages cereal – cereal sequence decreased fever grains cob^{-1}. Nitrogen harvest index is more. Nitrogen is taken off with less litters contribution to soil. Kernel weight is a function of assimilate availability; kernel growth duration and rate of assimilate supply. Number of sinks/unit area, container capacity and sink strength, (competing power to withdraw assimilates) to grains. Damage prior to anthesis can reduce kernel number/plant exposure at anthesis after kernel primordia limit cereal yield (Amundson *et al.,* 1987). Grain yield depends upon number of kernels per unit area and kernel weight. Grain filling in cereals characteristically begins a few days after anthesis and lasts until grain filling is nearly completed. The rate of grain growth mg $kernel^{-1}$ day^{-1} during linear period increased moderately with temperature. Each degree increase in temperature during grain filling gave a 3 days decrease in duration of filling. A 1.04mg decrease in kernel weight for each degree Celsius increased in temperature; short the grain filling duration and kernel weight, respectively. Maize grain yield increases to preceding legumes ranged up to 52% depending on site not on nutrient contribution alone. All crops produced highest grain yield following fallow, i.e. 74%, 25% and 10% higher their respective monoculture fields (Peterson *et al.* 1999). Tasselling were delayed up to 54 when maize was established on shaftal without cut, after taking three cuts and on preceding barley plots. Unfertilized plots delayed tasselling 1-2 days as compared with the rest. Silking was delayed up to 59 when maize was grown on previous wheat and barley plots as compared with legume plots. Zero nitrogen application delayed silking took 60 days. While 40-120kg N ha^{-1} application decreased the number of days to silking or silking was enhanced earlier. (**Days to 50% tasseling, silking, year, 1, 2 and combined mean tables have been skipped).**

Maize days differences between tasselling and silking treatment means showed wide gap i.e. 6 days. Four days difference silking after tasselling was noticed when maize was planted on shaftal after taking three cuts. Maize planted on 0, 1 and 2 cuts, zero days' difference was observed or tasselling and silking were concided. Nitrogen @ 120kg N ha^{-1} had significantly reduced days differences tasselling to silking. Under unfertilized situations irrespective of legumes and their cuttings techniques gap between silking after tasselling were increased up to 6 days. Maximum grain filling days 43 were utilized by maize when grown on preceding fallow plots vs cropped. Rabi legumes vs cereals followed by summer maize availed 42 and 41grain filling days. Interaction of (legume cuttings x N) after single cut and enriched with 80-120kg N ha^{-1}, grain filling duration was increased up to 44 days. Control and low N had decreased filling days.

CONCLUSION

Conclusively coincidence and less days differences between tasseling and silking increased grain fill duration, fertilized competent ovules in maize. Overlapping of stamminate and pistillate inflorescences bring forth fruitful bearings. Wide gap between protanderness and protogynousness yields gappy cobs. Early silking can be enhanced by adequate nitrogen. Biomass incorporation and adequate nitrogen correct the synchronization for final harvest.

REFERENCES

Amundson, R.G. R.J. Kohat, A.W. Schietle., R.W. Raba, and P.B. Reich. 1987. Correlative reductions in whole plant photosynthesis and yield or winter wheat caused by ozone. Physio. Biochem. Vol. 77: 75-79.

Bruckner, P.L., and R.C. Frohberg. 1987. Rate and duration of grain fill in spring wheat. Crop Sci. Vol. 27: 451-455.

Gokmen, S., O. Sencar, and M.A. Sakin. 2001. Response of pop corn (Zea mays everta) to nitrogen rates and plant densities. Turkish Journal of Agriculture and Forestry. Vol. 25(1): 15-23.

Martiniello, P., G.D. Santis, A. Lannucci and D.Santis. 1996. Effect of Phenological stages on plant dry matter partitioning and seed production in berseem. J. of Agronomy and Crop Sci. Vol. 177: 39-48.

Peterson, T.A., C.A. Shapiro, and A.D. Flowerday. 1999. Rainfall and previous crop effects on crop yield. J. alternative Agric. Vol. 5(1): 33-37.

Ritichie, and Hanway. 1982. Vegetative and reproductive growth stages of maize plant. Iowa. Ext. Serv. Spec. Rep. pp. 48.

Steel, R.G.D., and J.H. Torrie. 1980. Principles and procedures of statistics. 2nd Ed. McGraw Hill Book Company, Inc., New York.

Stopes, C., S. Millington, and L. Woodward. 1996. Dry matter and nitrogen accumulation by three leguminous green manure species and the yield of a following wheat crop in an organic production system. Agric. Eco. Systems and Environment. 57:189-196.

Stulen, F., L. Lanting, H. Lambers, F. Posthumous, Van de S.J. Dijk, and R. Hotstra. 1981. Nitrogen metabolism of plantago lanceolata as dependant on the supply of mineral nutrients. Plant Physiology. Vol. 51: 93-98.

Sullivan, P.G., D.J. Parrish, and J.M. Luna. 1991. Cover crops distribution to N. supply and water conservation in corn production. J. Alternative Agric. Vol. 6(3): 106-113.

Tian, G., J.A. Olimab, G.O. Adeoye, and B.T. Kang. 2000. Regeneration of earthworm populations in a degraded soil by natural and planted fallows under humid tropical conditions. Soil Sci. Soc. Am. J. (Madison, Wis) Soil Science Society of America. Vol. 64(1): 222-228.

Tomar, J.S. and R.J. Soper. 1981. Fate of tagged urea N in the field with different method of N and organic matter placement. Agron. J. Vol. 73: 991-995.

Tony, J.V., J. G. Faber, K.J. Janovicek, and E.G. Beauchamp. 2000. Cover crop effect on Nitrogen availability to Corn following Wheat. Agronomy J. Vol. 92: 915-923.

Towes, W.H. and R.J. Soper. 1978. Effect of nitrogen source method of placement and soil type on seedling emergence and barley crop yield. Can. J. Soil Sci. Vol. 58: 311-320.

Tylor, A.O.,and R.M. Touy. 1976. Production of forage legumes. Newzeland. J. Agri. Sci. Vol. 7: 149-152.

Wiegand, C.L., and J.A. Cuellar. 1981. Duration of grain filling and kernel weight of wheat as affected by temperature. Crop Sci. Vol. 21: 95-100.