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# Influence Of Date Of Planting And Time Of Introduction Of Maize On The Agronomic Performance Of Soybean-Maize Intercrop In Nigerian Southern-Guinea Savanna.

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**Abstract**
Field experiments were conducted during the 2007 and 2008 cropping seasons to investigate the influence of dates of planting and time of introduction of maize in a soybean/maize intercropping system at the Teaching and Research farm of the University of Agriculture, Makurdi. The experiment was laid out in a split-split plot replicated three times with two dates of planting (June 27$^{th}$ and July 27$^{th}$), three periods of introductions of maize (Simultaneous, two weeks after planting soybean and four weeks after planting soybean) and three cropping pattern (soybean sole, maize sole and soybean/ maize intercrop). The results obtained indicated that maize planted sole was significantly ($p<0.01$) taller than intercropped maize. There was significant reduction in maize plant height with delayed introduction and delayed planting. Days to 50% tasseling in maize was not significantly affected by time of introduction of maize. There was no significant effect of date of planting on vegetative or flowering parameters of maize assessed. The yield components and yield of maize decreased with delayed maize introduction. Date of planting only had significant effect ($p<0.05$) on 100-seeds weight of maize. Plant height and 50% flowering of soybean were significantly ($p<0.05$) affected by date of planting while there was no significant effect of time of introduction of maize on any soybean parameters observed. Results indicated significant effect of cropping pattern on number of pods/plant and grain yield. The Land Equivalent Ratio (LER) values generally showed advantages of intercropping, but higher advantages were obtained from maize introduction after two weeks of planting soybean.
**Keywords;** Intercropping, Dates of planting, Time of introduction, yield and yield component, Land Equivalent ratio.

## INTRODUCTION

Soybean (Glycine max (L) Merr.) is an integral component of the traditional cropping systems of the Southern Guinea Savanna agro ecological zone of Nigeria due to its beneficial effect on sustainability and as a source of nutritious food (Henrient et al., 1997). The importance of soybean is predicated on its high nutritious quality with respect to its protein and oil. From the nutritional standpoint, it ranks high in the protein quality index as ascertain by the Food and Agricultural Organization (Langer and hill, 1991).
Maize (Zea mays L.) is grown almost in all parts of the country except where rainfall becomes a limiting factor. Maize evolved in the country from a backyard crop in 1970s to a commodity which presently, ranks third in output only to sorghum and millet in the cereal group. Maize is increasingly being acceptable as a major source of food and cash income among its predominantly small holder producers in Nigeria (NARP, 1994)
Intercropping legumes and non- legumes is an important feature of many cropping systems in the tropics (Willy, 1979; CIAT, 1986). It is said to be a principal means of intensifying crop production and improving returns from small land holdings (Storck et al., 1991). Olufajo and Singh (2002) reported that the productivity of legumes in legume- cereal intercropping is low, mainly due to competition. Ennin et al., (2002) have attributed this low productivity to both interspecific and intraspecific competition for limited resources. A number of measures have been recommended for achieving increase in legume productivity in intercropping among which are , identifying the best suitable time of sowing the component crops in the intercropping (Singh and Ajeigbe, 2002),and choice of suitable companion crop in the intercropping (Olufajo,1995). Date of sowing any crop is dictated by many factors including weather, soil condition, management and crop production systems (Olufajo and Singh, 2002). IITA (1986) observed that the choice of planting date is determined by four factors, namely, the need to plant when soil condition including soil temperature are favourable for good seedling emergence, the need to provide adequate soil moisture throughout the crop growth to obtain high yield and the need to have dry period during maturation to obtain high seed quality and facilitate harvesting and drying. IITA (1989) recommended proper adjustment of time of sowing, spacing and plant types so as to minimize competition for light to enhance productivity, that, the growth habit and plant architecture must be considered when deciding to defer planting of any component crop, that, crop first introduced usually becomes more aggressive than when

 

both crops are sown simultaneously, and only when there is a weak competitor in a mixture is it advisable to enhance its performance by sowing it early relative to the aggressor.

In Nigeria, soybean is chiefly grown in Benue state as a cash crop by small farm holders who usually grow it in mixture simultaneously with cereals. Records have shown that the farmers have not been maximizing profit because of low productivity (Olufajo and Singh, 2002). Previous work on soybean/maize have addressed various factors that influence the performance of crops under varying population densities, varietal suitability, cultivar and plant arrangement amongst others (Tayo,1977; Olufajo,1986; Olufajo,1995). However, there is dearth of information on the influence of soybean/maize as affected by date of planting and time of introduction of maize, therefore, this work was design to investigate and provide available information.

## MATERIALS AND METHODS

Field experiments were conducted during the 2007 and 2008 cropping seasons to investigate the influence of dates of planting and time of introduction of maize in a soybean/maize intercropping system at the teaching and research farm of the University of Agriculture, Makurdi (7.41$^{o}$N ; 8.28$^{o}$E ) which falls within the Southern Guinea Savannah agro-ecological zone of Nigeria.

The experimental design was a 2x3x3 split - split plot laid in a randomized complete block design replicated three times. Two dates of planting (27$^{th}$ June and 27$^{th}$ July), three times of introduction (planting soybean and maize simultaneously, maize introduced two weeks after planting soybean and maize introduced four weeks after planting soybean) and three cropping patterns (soybean sole, maize sole and soybean intercrop with maize).maize variety DMR-ESR-Y and soybean variety TGX1448-2E were obtained from National Cereal Research Institute sub station Gboko. Each experimental unit (plot size) measured 5mx3m with four ridges of 5m long spaced 0.75m, site clearing and ridge making was done manually, spacing for maize sole was recommended spacing of 0.75m x 0.5m at 2 plants per stand giving a population of approximately 53,333 plants per hectare. Intercrop maize was spaced 0.75m x 0.5m at one plant per stand using the semi additive mixture as stated by Fisher (1977) giving a population of approximately 26,666 plants per hectare. Spacing for soybean was 0.75m x 0.05m at one plant per stand giving a population of approximately 266,666 plants per hectare. Maize seeds were sown (4 seeds/hill) on the side of the ridges and thinned to two plants per stand for sole and one plant per stand for intercrop, soybean was sown on top of the ridges with the seeds drilled, which were thinned to one plant per stand both for sole and intercrop.

Fertilizer was applied based on recommended fertilizer rates for Benue State as follows- maize sole-90kgN/ha, 45kg$P_2O_5$ and 45kg$K_2O$/ha (300kg of NPK:15:15:15/ha as first split application and 100kg urea/ha as second split application.)

Soybean -- 10kgN/ha, 36kg$P_2O_5$/ha and 20kg$K_2O$/ha (22kg of urea/ha, 200kg of SSP/ha and33kg/ha of MOP).

Intercrop – 200kg/ha of NPK-15:15:15 as first split application and 200kg/ha of SSP on soybean and 100kg/ha of urea on maize as second split application (.Kalu, 1993). Data collected on maize were plant height, number of days to 50% tasseling and silking, number of leaves per plant, leaf area, number of ears per plant, ear diameter, ear length, percent survival, percent barrenness, weight of 100 seeds and net yield. Data collected on soybean were – plant height, number of days to 50% flowering, number of primary branches, number of pods per plant, number of seeds per pod, leaf area, weight of 100 seeds and net yield.

Both crops were harvested when they were fully matured and dried. All the data collected were subjected to analysis of variance using Genstat (version 5) statistical package. Land Equivalent Ratio was computed as stated by Mead and Willey (1980). Competitive Ratio was computed as stated by Willey and Rao (1980)

## RESULTS:

### Maize – Vegetative and Flowering component

Results of mean effects and interaction effects of various dates of planting, different times of introduction and cropping patterns on the vegetative and flowering data of maize are as presented in table 1. There were no significant differences in the vegetative and flowering traits of maize for the different dates of planting and for the different years. However, time of introduction of maize had significant effects on all vegetative and flowering traits of maize. Results also showed significant differences between four weeks of introduction ($T_3$) and the other times of introduction ($T_1$ and $T_2$) for plant height (which decreased with delayed introduction of maize). For days to 50% tasseling, simultaneous planting of maize and soybean ($T_1$) and introduction of maize at two weeks ($T_2$) were not significantly different but showed significant lower values compared with introduction of maize at four weeks ($T_3$). However, for days to 50% silking, two weeks of introduction of maize showed higher values with no significant differences among the various times of introduction. Number of leaves per plant showed the same trend as days to 50% silking. There were no significant effects of cropping pattern on 50% tasseling and silking as well as number of leaves per plant.

Cropping pattern significantly affects plant height, there were highly significant differences between maize planted sole ($CP_2$) and intercropped maize ($CP_3$) for plant height.( Maize planted sole grew taller than

 

intercropped maize). Furthermore, there were highly interaction effects of time of introduction and cropping pattern (T x CP) on plant height and number of leaves per plant. Plant height both for sole and intercrop maize decreased with delayed time of introduction. However, for number of leaves per plant, maize planted sole did not significantly differed from intercropped maize ($CP_3$)

**Table; 1 Effect of planting dates, time of introduction of maize and cropping pattern on some maize vegetative and flowering characters in soybean-maize intercrop**

| | | plant height (cm) | | Days to 50% tassel | | Days to 50% silking | | No of leaves | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 |
| Date of | $D_1$ | 153.6 | 158.6 | 55.15 | 56.13 | 61.37 | 59.36 | 11.29 | 11.74 |
| planting | $D_2$ | 145.7 | 147.9 | 55.96 | 56.78 | 61.19 | 60.12 | 11.46 | 11.78 |
| $LSD_{0.05}$ | | NS | NS | NS | NS | NS | NS | NS | NS |
| Time of | $T_1$ | 164.7 | 169 | 55.28 | 55.22 | 60.28 | 60 | 11.61 | 11.36 |
| introduct- | $T_2$ | 157.6 | 163.1 | 57.28 | 57.67 | 62.22 | 62.67 | 13.22 | 12.33 |
| ion (T) | $T_3$ | 126.7 | 129.3 | 67.06 | 58.56 | 61.33 | 61.44 | 10.2 | 10.19 |
| $LSD_{0.05}$ | | 10.67 | 19.52 | 2.11 | 2.62 | 1.13 | 2.03 | 7.59 | 1.42 |
| Cropping pattern | $CP_2$ | 170.2 | 178.3 | 55.78 | 54.56 | 61 | 61.22 | 11.69 | 11.58 |
| cp | $CP_3$ | 139 | 143.1 | 55.44 | 55.89 | 61.5 | 61.44 | 11.29 | 11.39 |
| $LSD_{0.05}$ | | 8.57 | 10.47 | NS | NS | NS | NS | NS | NS |
| T x CP | $T_1$ x $CP_2$ | 175.6 | 183.5 | | | | | 11.43 | 11.07 |
| | $T_1$ x$CP_3$ | 159.3 | 163.5 | | | | | 11.87 | 12 |
| | $T_2$ x $CP_2$ | 170 | 187.2 | | | | | 12.37 | 12.47 |
| | $T_2$ x $CP_3$ | 148.8 | 148.8 | | | | | 12.27 | 12.47 |
| | $T_3$ x $CP_2$ | 165 | 164.2 | | | | | 11.27 | 11.2 |
| | $T_3$ x $CP_3$ | 109 | 117 | | | | | 9.75 | 9.7 |
| $LSD_{0.05}$ | | 15.29 | 21.39 | | | | | 0.95 | 1.43 |

$D_1$= June 27th planting, $D_2$=July 27th planting, $T_1$=simultaneous planting of maize and soybean, $T_2$= maize introduced two weeks after planting soybean, $T_3$=maize introduced four weeks after planting soybean, $CP_2$=maize planted sole, $CP_3$= maize intercrop with soybean

**Maize – yield and yield component**

Results of yield and yield component of maize as influenced by date of planting, time of introduction of maize and cropping pattern are as shown in table 2. Date of planting had significant effects ($P<0.05$) only on 100 – seed weight and there was significant differences between the two dates of planting. (seed weight decreased with delayed planting). There were significant differences in the ear diameter, ear length, percent barrenness, percent survival, 100 – seed weight and grain yield for the different time of introduction of maize. The result showed that these parameters (excerpt percent barrenness which increased) decreased with delayed maize introduction.
Significant differences between four weeks of maize introduction ($T_3$) and other times of introduction of maize ($T_1$ and $T_2$) for percent survival, percent barrenness and grain yield were also observed, while significant differences existed between the various times of introduction of maize for ear length and 100 – seed weight.

Cropping pattern significantly affected ear diameter, ear length, percent survival, percent barrenness and grain yield. Maize sole ($CP_2$) significantly differed from intercropped maize ($CP_3$) for ear length, ear diameter, percent survival and grain yield (all of which were lower in intercropped maize ) but percent barrenness increased in intercropping while no significant differences were observed for 100 – seed weight. Significant interaction effects occurred between date of planting and time of introduction of maize (D x T) for ear length, percent survival and grain yield. Significant time of introduction by cropping pattern (T x CP) was also observed for percent survival and percent barrenness. Significant second order interactions of the factors (D x T x CP) occurred for 100 – seed weight.

 

Table :2 Effects of planting dates, time of introduction of maize and cropping pattern on the grain yield and yield component of maize in soybean- maize intercrop.

| | | Ear length (cm) | | Ear diameter (cm) | | Percent. Barreness | | percent. Survival | | 100 seed weight (g) | | Net yield (kg/ha) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 |
| Date of | $D_1$ | 11.8 | 11.9 | 3.51 | 3.58 | 22.9 | 19.42 | 80.09 | 80.27 | 20.33 | 20.33 | 5.71 | 6.81 |
| planting | $D_2$ | 11.2 | 11.29 | 3.41 | 3.46 | 19.5 | 19.7 | 80.32 | 80.02 | 15.33 | 15.33 | 4.97 | 4.86 |
| LSD.$_{0.05}$ | | NS | NS | NS | NS | NS | NS | NS | NS | NS | 3.18 | NS | NS |
| Time of introduct ion T | $T_i$ | 13.89 | 13.23 | 3.51 | 3.85 | 10.13 | 11 | 94.44 | 98.3 | 19.89 | 22 | 6.56 | 6.92 |
| | $T_2$ | 10.91 | 11.7 | 3.33 | 3.56 | 13.89 | 14.4 | 88.19 | 91.3 | 18.28 | 20.33 | 5.72 | 4.95 |
| | $T_3$ | 9.69 | 10.46 | 3.21 | 3.11 | 39 | 41.9 | 57.99 | 50.7 | 15.33 | 18.67 | 4.01 | 3.03 |
| LSD.$_{0.05}$ | | 1.16 | 1.15 | 0.29 | 0.23 | 8.19 | 12.35 | 8.56 | 10.28 | 1.28 | 2.66 | 1.04 | 1.01 |
| Cropping pattern cp | $CP_2$ | 13.82 | 14.74 | 3.75 | 3.95 | 7.3 | 10.1 | 92.36 | 93.8 | 17.72 | 20.11 | 9.76 | 9.4 |
| | $CP_3$ | 10.32 | 10.42 | 3.24 | 3.22 | 28.9 | 30.5 | 72.92 | 72.2 | 17.94 | 20.67 | 3.33 | 2.9 |
| LSD.$_{0.05}$ | | 1.02 | 1.52 | 0.21 | 0.3 | 5.3 | 6.07 | 5.03 | 5.56 | NS | NS | 1.33 | 1.6 |
| D x T | $D_1$ x $T_1$ | 13.32 | | | | | | 98.18 | | | | 6.92 | |
| | $D_1$ x $T_2$ | 11.7 | | | | | | 91.32 | | | | 4.95 | |
| | $D_1$ x $T_3$ | 10.46 | | | | | | 50.69 | | | | 4.98 | |
| | $D_2$ x $T_1$ | 14.55 | | | | | | 90.63 | | | | 6.24 | |
| | $D_2$ x $T_2$ | 10.11 | | | | | | 65.07 | | | | 5.5 | |
| | D2 x $T_3$ | 8.93 | | | | | | 65.28 | | | | 3.03 | |
| LSD.$_{0.05}$ | | 1.67 | | | | | | 9.91 | | | | 1.43 | |
| T x CP | $T_1$ x $CP_2$ | | | | | 5.5 | 6.3 | 93.75 | 99 | | | | |
| | $T_1$ x $CP_3$ | | | | | 13.4 | 15 | 94.79 | 97.9 | | | | |
| | $T_2$ x $CP_2$ | | | | | 6.2 | 6.4 | 93.75 | 94.6 | | | | |
| | $T_2$ x $CP_3$ | | | | | 16.6 | 21 | 84.37 | 89.6 | | | | |
| | $T_3$ x $CP_2$ | | | | | 10 | 17.7 | 89.58 | 87.5 | | | | |
| | $T_3$ x $CP_3$ | | | | | 54.6 | 55.6 | 39.58 | 29.2 | | | | |
| LSD.$_{0.05}$ | | | | | | 10.46 | 13.14 | 10.5 | 11.3 | | | | |

$D_1$= June 27$^{th}$ planting, $D_2$=July 27$^{th}$ planting, $T_1$=simultaneous planting of maize and soybean, $T_2$= maize introduced two weeks after planting soybean, $T_3$=maize introduced four weeks after planting soybean, $CP_2$=maize planted sole, $CP_3$= maize intercrop with soybean

**Soybean – Vegetative and Flowering Component**

Date of planting significantly affected soybean plant height and days to 50% flowering but had no significant effect on number of primary branches and leave area of soybean (Table 3). Soybean plant height decreased

 

significantly with delayed planting. Time of introduction of maize (T) had no significant effect on any vegetative flowering traits of soybean.Leaf area and days to 50% flowering of soybean were significantly affected by cropping pattern. Generally there was an increase in leaf area and days to 50% flowering for soybean intercropped. Meanwhile, cropping pattern showed no significant effects on soybean plant height and number of branches.

Table 3: Effects of planting dates, time of introduction of maize and cropping pattern on vegetative and flowering characters of soybean in soybean – maize intercrop

| | | Plant height (cm) | | Number of branches | | Leaf area (cm) | | Days to 50% flo. | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 |
| Date of | $D_1$ | 64.29 | 63.74 | 6.1 | 7.4 | 48.94 | 49.24 | 39.56 | 40.62 |
| planting D | $D_2$ | 43.07 | 42.66 | 8.8 | 7.1 | 49.39 | 48.33 | 40.83 | 41.82 |
| LSD. $_{0.05}$ | | 13.9 | 15.14 | NS | NS | Ns | NS | 0.84 | 0.92 |
| Time of | $T_1$ | 56.08 | 65.16 | 6.5 | 6.02 | 47.45 | 45 | 40.42 | 39.75 |
| introduct | $T_2$ | 52.47 | 65.38 | 6.2 | 5.97 | 51.73 | 53.05 | 40.04 | 39.25 |
| ion T | $T_3$ | 52.5 | 62.34 | 9.7 | 6.28 | 48.31 | 48.78 | 40.13 | 39.67 |
| LSD. $_{0.05}$ | | NS | NS | NS | NS | NS | NS | | NS |
| Cropping | $CP_1$ | 51.78 | 60.65 | 10.2 | 5.69 | 44.37 | 43.1 | 39.5 | 38.67 |
| pattern cp | $CP_3$ | 55.77 | 65.99 | 6.4 | 6.62 | 52.18 | 54.62 | 40.78 | 40.11 |
| LSD. $_{0.05}$ | | NS | NS | NS | NS | 4.89 | 5.55 | 0.94 | 1.12 |

$D_1$= June 27$^{th}$ planting, $D_2$=July 27$^{th}$ planting, $T_1$=simultaneous planting of maize and soybean, $T_2$= maize introduced two weeks after planting soybean, $T_3$=maize introduced four weeks after planting soybean, $CP_1$=soybean planted sole, $CP_3$= maize intercrop with soybean

**Soybean – yield and yield components**

Results on yield and yield component of soybean are as presented in Table 4. Date of planting and time of introduction of maize had no significant effects on all the parameters quantified. However, there were significant effects of cropping pattern on number of pods/plant and grain yield. Whereas for number of pods/plant there was no significant differences between sole planted and intercropped.

Table 4: Effects of planting dates, time of introduction of maize and cropping pattern on grain yield and yield component of soybean in soybean-maize intercrop

| | | N0 of pods /stand | | No of seeds /pod | | 100 seeds weight | | Grain yield (kg/ha x $10^3$) | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 | 2007 | 2008 |
| Date of | $D_1$ | 73.4 | 78.7 | 23.03 | 2.3 | 12.42 | 12.2 | 1.3 | 1.36 |
| planting D | $D_2$ | 68.1 | 70.3 | 23.24 | 2.3 | 11.5 | 11.8 | 1.29 | 1.24 |
| LSD. $_{0.05}$ | | NS | NS | NS | NS | NS | NS | NS | NS |
| Time of | $T_1$ | 67.2 | 67.2 | 2.33 | 2.32 | 12.17 | 12.67 | 1.19 | 1.13 |
| introduct | $T_2$ | 74.2 | 77.3 | 2.24 | 2.25 | 11.79 | 12.25 | 1.27 | 1.29 |
| ion T | $T_3$ | 70.9 | 75.8 | 2.34 | 2.35 | 11.92 | 12.33 | 1.41 | 1.49 |
| LSD. $_{0.05}$ | | NS | NS | NS | NS | NS | NS | NS | NS |
| Cropping | $CP_1$ | 67.4 | 70.4 | 2.31 | 2.31 | 11.72 | 11.78 | 1.31 | 1.26 |
| pattern cp | $CP_3$ | 68.2 | 69 | 3.35 | 2.35 | 12 | 12.67 | 1.12 | 1.04 |
| LSD. $_{0.05}$ | | 11.32 | 2.67 | Ns | NS | NS | NS | 0.14 | 0.27 |

 

$D_1$= June 27th planting, $D_2$=July 27th planting, $T_1$=simultaneous planting of maize and soybean, $T_2$= maize introduced two weeks after planting soybean, $T_3$=maize introduced four weeks after planting soybean, $CP_{1=}$ soybean planted sole, $CP_3$= maize intercrop with soybean

**Land Equivalent Ratios (LER) and Competitive Ratio (CR)**

The LERs and CRs of maize/soybean intercropping are as presented in Table 5. generally, LER values were greater than unity (>1.00), however, introduction of maize two weeks after planting produced highest LER values (1.30 and 1.28) excerpt in 2007 27th June planting where LER was 1.12.

Highest CR value (0.66) of maize/soybean intercropping was obtained when maize was introduced two weeks after planting soybean and at $D_1$ (27th June planting). Generally, CR values of 27th July planting at the various times of introduction were lower than those of June planting. Furthermore, CR values decreased with delayed maize introduction,

Table 5 : Land Equivalent Ratio (LER) and Competitive Ratio (CR) of soybean-maize mixture as influenced by planting date, time of introduction of maize and cropping pattern.

| Date of planting (D) | Time of introduction T | LER | | CR | |
|---|---|---|---|---|---|
| | | 2007 | 2008 | 2007 | 2008 |
| | $T_1$(soybean/maize) | 1.06 | 1.04 | 0.66 | 0.65 |
| $D_1$ (27th June) | $T_2$ (soybean/maize) | 1.12 | 1.28 | 0.56 | 0.59 |
| | $T_3$ (soybean/maize) | 1.22 | 1.22 | 0.52 | 0.54 |
| | $T_1$ (soybean/maize) | 1.24 | 1.22 | 0.48 | 0.47 |
| $D_2$ (27th July) | $T_2$ (soybean/maize) | 1.3 | 1.28 | 0.43 | 0.44 |
| | $T_3$ (soybean/maize) | 1.03 | 1.04 | 0.17 | 0.19 |

$D_1$= June 27th planting, $D_2$=July 27th planting, $T_1$=simultaneous planting of maize and soybean, $T_2$= maize introduced two weeks after planting soybean, $T_3$=maize introduced four weeks after planting soybean.

DISCUSSION

The observed reduction of plant height in maize with delayed introduction when intercropped with soybean and delayed planting could be as a result of reduced nutrient by heavy rains and poor emergence of July planting. These findings were in agreement with the report of Ojo et al., (1992) that plant and ear height decreased progressively as planting was delayed. In the current study, sole maize tasseled and silked at the same period with intercropped maize does not agree with the report of Ugen and Wien (1986) that sole maize tasseled and matured earlier than intercropped maize. The significant reduction in ear length and ear diameter of maize with intercropping and delayed planting could be attributed to inter-specific competition and variation in the weather conditions especially in terms of solar radiation, humidity and temperature as the season progressed since these weather factors have a profound influence in the growth and development of maize. Similar findings have been reported by Elmore and Jacobs (1984) and Enyi (1973).

The much reduction in maize grain yield in intercropped could be as a result of the semi additive population used, which translates to half maize population in cereal/legume intercropping, in order to reduce excessive shading (Fisher, 1977). Soybean plants grown in mixture were taller than those grown sole. These could be attributed to the shading effect of maize on soybean. Duncan et al., (1991) also observed taller plants in intercrop than mono-

 

crop, and attributed the increase in height to elongation of lower internodes due to shading effect of the cereal on soybean. Days to 50% flowering in soybean was significantly affected by date of planting and cropping pattern. Pal et al., (1985) observed significant differences in flowering when planting dates were varied from 1st June to 27th July. The significant difference in soybean leaf area due to cropping pattern could be due to limited solar radiation the soybean received due to shading from the maize plant. This is consistent with the findings of Adiku et al., (1995) that intercropping had little or no effect on cereal leaf area but had considerable influence on the development of intercropped legume. The lower number of soybean pods/plant obtained in intercrop could be due to shading and competitive effect by the taller maize as reported by Dalai (1977). Yield reduction in intercrop was related to reduce number of pods/plant because number of pods significantly influences yield. (Akanda and Quayyaum, 1982). Grain yield in the two crops studied was not significantly influenced by date of planting, However, soybean planted in July ($D_2$) yielded less than that in June ($D_1$) planting. Fisher (1980) and Pal et al., (1985) reported June as optimum planting time for soybean in savanna area, pointing out that delayed planting in some cases led to drastic yield reduction. Maize yield follow the same trend as for soybean. Kalu et al., (1986) reported progressive yield decrease to the magnitude of 0.5 t/ha for each mouth of delayed maize planting while Ojo et at., (1992) reported that planting maize for optimum yield is in the mouth of June in the Guinea savanna zone. In the current study, highest LER and CR values were obtained from two weeks delayed maize introduction perhaps because delayed maize introduction helped the soybean plant to withstand competition while at the same time not significantly affecting the maize plant.

## CONCLUSION

Generally, the result obtained showed yield advantage of intercropping compared with sole cropping. The LER values indicated that higher yield advantages were obtained from maize introduced after two weeks of planting soybean. However, it can be concluded that in Makurdi, a location within the Guinea savanna agro-ecological zone of Nigeria, for higher yield, maize should be introduced two weeks after planting soybean in the mouth of June or if maize is to be planted with soybean by July, then simultaneous planting of maize with soybean is to be adopted. It is however recommended that further investigation be conducted across different locations in the Guinea savanna agro ecological zone of Nigeria.

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