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# THE PRELIMINARY STUDY OF THE IMPACT OF CLIMATIC VARIABLES ON THE GROWTH OF MELON IN KWARA STATE

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## 1.0 Introduction

Agricultural production system is a man-made ecosystem. As natural ecosystem is under going adjustments resulting from climate change so also the man-made ecosystem undergoes greater stress in response to climate change because of its limited species. The adjustment according to Adefolalu (1999) may lead to elimination of certain crops, introduction of new crops, which may lead to expansion, or contraction of the range of crops cultivated.

Among other factors of climate change is fluctuation observed in rainfall amount, distribution and onset over the years. Rainfall has been acknowledged as the most crucial climatic factor of agricultural production system of the tropics (Oguntinyinbo, 1981; Olaniran, 1988). Its fluctuation is associated with widespread crop failures and loss of livestock (Oguntinyinbo and Richard 1977, Olanrewaju 2001 and Olaniran 2002). An example of such crop in Kwara state is melon among others.

Melon (*citrullus lanatus*) is a popular grain legume in Nigerians diet. Its importance reflects from various roles it performs. As food, the edible seeds are blended into pastry used as local soup thickener, processed into a snack called 'robo' (in Yoruba), and the oil extracted can be used domestically and industrially. Melon is rich in protein and in oil content (Joda et al 1996). Another dimension is that melon plant is also used traditionally to control weeds (Unamma et al 1990), helps in biological nitrogen fixation, soil water conservation and erosion control (Kolo 1991).

The production level of this crop in Kwara State has been very low of recent (Table 1). This has led to increase in melon price all over the State. For instance, the Monitoring and Evaluation Unit of the Kwara State Agricultural Project (KADP) in the annual report for year 2002 noted an increase from ₦94.88 per kg of shelled melon in the year 2000 to ₦115.15 per kg in the year 2001 in Urban Markets. In rural markets, one kg of shelled melon sold for ₦75.0 in the year 2000 skyrocketed to almost ₦100 the following year. Thus, effort is geared towards investigating the factors responsible for low and erratic production of melon in Kwara state for efficient planning and decisions towards global food security.

Table 1: Melon Yield (ton/ha) 1991-2000

| Year | Yield ton/ha (000) |
|------|--------------------|
| 1991 | 0.23               |
| 1992 | 0.19               |
| 1993 | 0.15               |
| 1994 | 0.25               |
| 1995 | 0.15               |
| 1996 | 0.31               |
| 1997 | 0.15               |

|      |      |
|------|------|
| 1998 | 0.30 |
| 1999 | 0.52 |
| 2000 | 0.20 |

Source: Kwara ADP and Author's field survey, 2003

### 1.1 Melon (*Citrullus lanatus*) production in Kwara State

In Kwara State, egusi melon (*Citrullus Lanatus*) is planted as a rainfed crop in the early wet season of April – August. The second crop of the late season (August - December) is rarely planted. Melons are of three types (based on the colour of the seed edge) namely, one with no seed edges called 'Sewere' in Yoruba, black edges and white edges. These last two are known as 'bara' in Yoruba. The most popular type grown in Kwara State is the black seed edges (Denton and Adeniran, 1990). It is characterized with big seed size and thick coat. Once planted at the onset of rain it germinates and emerges on the 5<sup>th</sup> day, vine starts spreading by 22<sup>nd</sup> day and cover ground fully by the 30<sup>th</sup> day. Flowering commences between 54<sup>th</sup>-50<sup>th</sup> day and reach maturity by about 150<sup>th</sup> day from planting (KADP Monitoring and Evaluation Unit (2000)

### 2.0 The Study Area

Ilorin, the study area, is located at latitude 8° 30'N and longitude 4°35'E (Fig. 1). Ilorin has the tropical wet-and-dry climate which supports tall grass vegetation interspersed with short trees. Wet season lasts from April till October with an average rainfall of 1218mm per annum. Temperature is high throughout the year. Farming constitutes the major occupation with more focus on root and grain crops.

### 3.0 Material and Method

#### 3.1 Types and Sources of Data

Meteorological and crop yield data were used in this study. The meteorological data involved is rainfall while melon yield represent the crop yield data. The meteorological data was from the meteorological station of Ilorin Airport while crop yield data was obtained from KADP as reported by the Planning, Monitoring and Evaluation Unit. Climatic data was collected for 30 years period of 1971-2000 but crop data collection covered only 10 years (1991-2000) representing the period for which data was available.

First of all, raw climatic data for the period in which crop yield is available (1991-2000) were partitioned based on the developmental stages of melon as recognized by KADP as follows:

- (a) The month of April represents the period of seed germination and plant emergence.
- (b) The month of May, which is the period of the spread of melon vines.
- (c) June-July: Period of flowering and pod formation.
- (d) August: Pod enlargement and maturity stage.

This partitioning will shed light on the degree of vulnerability of each developmental stage to rainfall fluctuations and measure to take in mitigating such impact.

Secondly, rainfall amount for the growing season length of melon was computed for the period of 1991-2000. This will enable us to examine annual fluctuation in rainfall compared with annual fluctuation in melon yield.

Finally, onset of rain was calculated based on 30 years period (1971-2000). This will help to compare onset of rains in the past with the present and therefore provide clue to the impact of onset of rain on melon in the past.

### 3.2 Data Analysis

In addition to the quantitative summary of the data, the simple regression method was used to investigate the relationship between climate and melon production.

### 4.0 Results and Discussion

Rainfall amount associated with various developmental stages of melon is displayed in table 2. Annual fluctuations of varying degrees exist during the four stages of melon. The month of April, which represents the period of germination and emergence of plant, has rainfall amount range of 23.8mm-223.0mm recorded in 1993 and 1994. Spreading of melon vines takes place in the month of May. The fluctuation in rainfall amount during month of May is not as pronounced as in the last stage. The range is between 105.6-336.7mm recorded in the year 2000 and 1991. The months of June and July mark the flowering and pod formation stage with annual rainfall amount range of 82.7-237mm reported in 1992 and 1999 respectively. Pod enlargement and maturity stage in August has a rainfall range of 49.2-334.6mm recorded in 1992 and 1994.

**Table 2: Rainfall (mm) Distribution during Various Developmental Stages of Melon Plant and Yield (1991-2000)**

|                                        | 1991  | 1992  | 1993  | 1994  | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  |
|----------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Germination & emergence<br>April       | 128.0 | 41.5  | 23.2  | 223.0 | 122.0 | 25.8  | 179.5 | 107.4 | 118.3 | 45.9  |
| Spreading of vine<br>May               | 336.1 | 140.4 | 141.4 | 156.0 | 209.6 | 143.2 | 216.9 | 169.2 | 171.3 | 105.6 |
| Flowering & pod formation<br>June-July | 217   | 82.7  | 144.6 | 110.4 | 195.4 | 117.8 | 94.5  | 211.8 | 237.8 | 137.6 |
| Pod enlargement & maturity<br>August   | 138.8 | 49.2  | 203.3 | 81.0  | 232.1 | 131.4 | 86.0  | 334.6 | 138.1 | 185.0 |

Sources: Author's computation 2003

**Table 3: Rainfall Distribution in various Developmental Stages of Melon and Yield (ton/ha) (1991-2000)**

| Month | Development stages | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|-------|--------------------|------|------|------|------|------|------|------|------|------|------|
| April | Germination        |      |      |      |      |      |      |      |      |      |      |

|           |                            |       |       |       |       |       |       |       |       |       |       |
|-----------|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|           | & emergence                | 128.0 | 41.5  | 23.8  | 223.0 | 122.0 | 25.8  | 179.5 | 107.4 | 118.3 | 45.9  |
| May       | Vines spreading            | 336.1 | 140.4 | 141.4 | 156.0 | 209.6 | 143.2 | 216.9 | 169.2 | 171.3 | 105.6 |
| June-July | Flowering & pod formation  | 217.0 | 82.7  | 144.6 | 110.4 | 195.4 | 117.8 | 94.5  | 211.8 | 237.8 | 137.6 |
| August    | Pod enlargement & maturity | 138.0 | 49.2  | 203.3 | 81.0  | 232.1 | 131.4 | 86.0  | 334.6 | 138.1 | 185.0 |
|           | Yield ton/ha               | 0.23  | 0.19  | 0.15  | 0.25  | 0.15  | 0.31  | 0.15  | 0.30  | 0.52  | 0.20  |

Source: Author's computation 2003

Yield of melon and rainfall pattern during the developmental stages of melon is displayed in table 3. Rainfall behaviour during all stages of development is vital to melon yield. However, it appears the first stage of melon development is most sensitive to rainfall. Years with sharp decline in their April rainfall recorded low yield of melon. Examples are 1992, 1993 and year 2000 having April rainfall records of 41.5, 23.8 and 45.9mm with their corresponding yield of 0.19, 0.15 and 0.20 ton/ha. Although April of 1994 and 1997 which recorded low yield was wet, the period of pod enlargement received too little rainfall (86.0mm) compared with others except during the 1992 August. To be more precise about the impact of rainfall amount on the yield of melon yield was correlated with rainfall amount of different developmental stages. The result is presented in Table 3b. High correlation was observed only between yield and rainfall amount during the flowering and pod formation stage indicating that rainfall amount alone cannot explain annual variation observed in melon yield. Hence, the influence of onset of rain on melon yield was considered.

Table 3b: Correlation of Yield and Rainfall Amount during the Developmental Stages of Melon

|       | Germination | Vines spreading | Flowering and Pod Development | Pod Enlargement |
|-------|-------------|-----------------|-------------------------------|-----------------|
| Yield | 0.059       | -0.076          | 0.478                         | 0.031           |

Source: Author's computation 2003

Table 4: Onset of Rain and Melon Production in Kwara State (1991-2000)

| Year | Date of onset of rain  | Yield Ton/ha |
|------|------------------------|--------------|
| 1991 | 10 <sup>th</sup> March | 0.23         |
| 1992 | 2 <sup>nd</sup> May    | 0.19         |
| 1993 | 4 <sup>th</sup> May    | 0.15         |
| 1994 | 4 <sup>th</sup> April  | 0.25         |
| 1995 | 4 <sup>th</sup> April  | 0.15         |
| 1996 | 24 <sup>th</sup> March | 0.31         |
| 1997 | 29 <sup>th</sup> April | 0.15         |
| 1998 | 8 <sup>th</sup> March  | 0.30         |
| 1999 | 16 <sup>th</sup> March | 0.52         |
| 2000 | 20 <sup>th</sup> April | 0.20         |

Source: Author's computation 2003

Table 4 shows the onset of rain and melon yield for the period 1991-2000. It appears onset of rain exerts greater impact on melon production than rainfall amount. Onset of rain was as erratic as

|       |
|-------|
| 45.9  |
| 105.6 |
| 137.6 |
| 185.0 |
| 0.20  |

melon yield during the period of study. Years that witnessed late establishment of rainfall recorded drastic decline in yield of melon. For instance, in 1992 when rain onset was delayed till 2<sup>nd</sup> May, melon yield was reduced to 0.19 ton/ha compared with 0.23 ton/ha reported in 1991 when rainfall was established as early as 10<sup>th</sup> March. A greater decline in melon yield reported for the year 1993 may be attributed to the dry spell of 29.8mm recorded in April after the establishment of planting date for March.

Variation in rainfall amount during the flowering stage may cause flowers to drop from the plants. This might explain reduction in yield of 0.25ton/ha observed in 1994 with rainfall amount of 110.4mm as compared with 0.15ton/ha when heavier rainfall amount of 195.9mm was recorded (Table 3). The year 1997 with a late onset of rain also recorded a sharp decline of 0.15ton/ha. The period of 1999 with early onset of rain (10<sup>th</sup> March) recorded the highest yield of 0.52 ton/ha. Early onset of rain places melon plant at an advantage of reaching flowering stage earlier during the month of May when rainfall intensity is light. Such rainfall intensity does not result in heavy loss of melon flowers out of which melon pods develop.

**Table4b: Onset of Rain in Kwara State (1971-1990)**

| Year | Start of the growing season (onset of rain) |
|------|---------------------------------------------|
| 1971 | 5 <sup>th</sup> April                       |
| 1972 | 14 <sup>th</sup> April                      |
| 1973 | 6 <sup>th</sup> April                       |
| 1974 | 9 <sup>th</sup> April                       |
| 1975 | 7 <sup>th</sup> April                       |
| 1976 | 14 <sup>th</sup> March                      |
| 1977 | 16 <sup>th</sup> April                      |
| 1978 | 26 <sup>th</sup> March                      |
| 1979 | 17 <sup>th</sup> March                      |
| 1980 | 1 <sup>st</sup> May                         |
| 1981 | 13 <sup>th</sup> March                      |
| 1982 | 6 <sup>th</sup> April                       |
| 1983 | 11 <sup>th</sup> April                      |
| 1984 | 18 <sup>th</sup> March                      |
| 1985 | 30 <sup>th</sup> March                      |
| 1986 | 14 <sup>th</sup> Feb                        |
| 1987 | 12 <sup>th</sup> May                        |
| 1988 | 15 <sup>th</sup> March                      |
| 1989 | 2 <sup>nd</sup> March                       |
| 1990 | 19 <sup>th</sup> April                      |

Source: Author's Computation, 2003.

Onset of rain can be described as normal, early and late. However, the period of the year designated normal, early and late is a function of the location of the area. However for Ilorin, based on the findings from Table 4, the period of early-mid April can be classified as normal onset of rain, the period from March downward can be described as early onset of rain while delayed onset begins from late April upward. The years of 1971-1990 are characterized by normal and early onsets of rain. Only two years (one in each decade) experienced delayed onset of rain and these were 1980 and 1987 respectively.

The frequency of different onsets of rain in different decades of 1971-2000 is presented in Table 5. A decline in the normal onset of rain through decades was established. The pattern shows a tendency towards late onset. The frequency of early onset fluctuates while late onset is on the

**Table 5: Frequency of Different Onsets of Rain in Different Decades (1971-2000)**

| Onset of Rain | 1971-1980 | 1981-1990 | 1991-2000 |
|---------------|-----------|-----------|-----------|
| Normal        | 6         | 3         | 2         |
| Early         | 3         | 6         | 4         |
| Late          | 1         | 1         | 4         |

Source: Author's Computation, 2003

increase. For instance the frequency of occurrence of late onset was one during 1971-1980 and between 1981-1990. However between 1991-2000 a sharp increase of four was recorded. According to Bello (1986) and Olaniran (2003) erratic behaviour of the onset of the rain depicts climate change. A shift in onset of the rain has brought a mismatch of environment and melon cropping in Ilorin area of Kwara state.

## 5.0 Conclusion

### Planning Implications

The link between rainfall and melon cropping was established in this study based on data analysed for Ilorin and its environ. It was found that low rainfall amount during seed germination encouraged poor yield. However high positive correlation was established between melon yield and rainfall during flowering and pod formation stage.

A shift from normal to late onset of rain has taken place. Such shift explained the erratic yield observed in melon during the period of 1991-2000. Farmers in the dry sub-humid areas are therefore encouraged:

- either to concentrate more on other crops upheld by climatic situations of the area rather than melon or
- Practice small-scale irrigation scheme to augment the climate of the area.
- Plant early maturing species of melon.

However, melon (*citrullus*) may thrive better in the southern guinea savanna ecology of Nigeria where establishment of rainfall comes up earlier than May.

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