Bayero Journal of Pure and Applied Sciences, 3(1): 96 - 99
Received: December, 2009
Accepted: May, 2010

EFFECT OF FARMYARD MANURE ON SENESCENCE, NITROGEN AND PROTEIN LEVELS IN LEAVES AND GRAINS OF SOME COWPEA VAREITIES

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ABSTRACT
The effect of farmyard manure was studied on senescence, nitrogen and protein content of the leaves and grains of cowpea. The experimental site for this study was situated at the International Institute of Tropical Agriculture (IITA), Kano Station, Nigeria. The cowpea varieties used in this experiment were Kanannado a local variety and IT89 KD – 288 an improved variety, two treatments were used for the experiment single manure treatment (manurexl), and double manure treatment (manurex2) at the ratio of 5:1 soil to manure and the control (no manure added). Plastic pots of 250mm diameter and 17.5cm for both length and height were used in this study. The pots were arranged in completely randomize block design and labeled appropriately using white and green plastic tags according to the plant treatment applied. The rainy season trial was carried out between August 2006 to November, 2006 while the dry season trial was carried out between October, 2007 to January, 2008 onset of senescence, days to 50% senescence, 90% senescence and days to total death of the plants occurred earlier in IT89KD – 288 than in Kanannado, while comparison between the treatments showed that senescence started earlier in plant treated with double manure treatment than those treated with single manure treatment. Between the two seasons, senescence started earlier rainy season than in dry season. On the other hand nitrogen and protein content of the leaves and grains were higher in IT89KD – 288 than in Kanannado, also between the treatment double manure treatment induced higher nitrogen protein content of leaves and grains. More nitrogen and protein, content of leaves and grains were obtained during the dry season trial than in the rainy season trial.

Keywords: Farmyard, Senescence, Cowpea, Protein, Manure

INTRODUCTION

Senescence means aging that ultimately leads to death, senescence in plants is a complex and highly regulated process that occurs as part of plant development. it is a pre – planned process, which can be seen in annuals such as rain crops that turn from green to golden as the grain ripens – before harvest. These changes, visible to the naked eye are accompanied with internal biochemical events, in which nutrients are being transferred from the leaves to other organs in the plant to be used in it's development (Green and Jones, 1982). Associated with the process is the degradation of cell contents (proteins, lipids, nucleic acids etc) resulting in the release of nitrogen, phosphorus and carbon as well as other minerals released from the senescing cells. Much of this material is redistributed to the rest of the plant either for new growth or for storage.

The fertilizers derived from animals, plants and microorganisms, are usually called organic manure or farm yard manure. Many kinds of farm yard manure are locally produced based on available natural resources. Examples includes chicken manure, goat manure and cowmanure (Vanek *et al.,* 2003).

On the other hand cowpea (*Vigna unguiculata(L.)* walp) is an important leguminous crop throughout sub – Saharan Africa, as well as in some parts of the Americas and Asia. It contributes a very important and inexpensive source of protein. Providing more than half of the plant protein in human diets. It contains about 23 – 25% of protein (Singh *et al.,* 1997). Cowpea are grown in a wide range of environment from 40^{o}N to 30^{o}S and in lowland and highland ecologies. They are principally grown in West Africa, but are also grown in Asia, latin America and North America (Rachie, 1985). In this study the role of farmyard manure, on senescence, and it's effect on nitrogen and protein content of leaf and grains of two cowpea genotype was investigated.

MATERIALS AND METHODS

The experimental site for this study was at the International Institute of Tropical Agriculture (IITA) Kano Station, Nigeria. Kano is situated at latitude 12^{o} 03'N, longitude 8^{o}34'E and altitude 486.5m (1595ft). Kano is characterized by two seasons, the rainy and dry seasons. The rainy season usually begins from May and ends in September with heavier rainfall in July and August, October to about may marks the dry season with little or no rainfall (Singh, 1992). Mean minimum and maximum temperatures during the study period were 21^{o}C and 31^{o}C respectively during the 2006 trial and 19^{o}C and 37^{o}C respectively in 2007 trial.

Planting

Plastic pots of 250mm diameter were used in this study. They were filled with fresh sandy loam top soil and watered well for two days before planting. There were ten replications per treatment. The treatments used were single manure application, double manure application and the control (no manure added). There were 2 planting periods 10th August, 2006 (rainy season) and 24th October, 2007 (dry season). Two cowpea varieties were used in the study, Kanannado local variety and IT89KD – 288 an improved variety which are both photoperiod sensitive. The seeds were collected from International Institute for Tropical Agriculture (IITA) Kano station. The seeds were directly sown on the prepared pots (after surface treatment with fungicide Apron plus) at 5 seeds per pot. They were later thinned to two plants per pot after germination; the pots were placed in completely randomized design (CRD) and labeled appropriately using white and green plastic tags according to the plant treatment applied.

The farmyard manure was applied at two levels for some plants, single application was made at planting and another set had two applications at planting and at flower but initiation stages. The farmyard manure was applied at the rate of 5:1 ratio of soil to manure respectively. The control plants had no manure added.

Data Collection

Destructive sampling of the treated and control plants were carried out. Three replicates were collected at each sampling date and averages recorded. Data was collected on senescence, the Changes in colour of leaves were observed visually and the extent of chlorophyll loss was monitored. Days to onset of senescence were counted and recorded for each plant. Likewise days to 50% of senescence, days to 90% of senescence and days to complete death of plant. From the data obtained the duration of senescence in the different treated and control plants were estimated in order to determine their effects on senescence in the cowpea varieties. Nitrogen and protein content of the leaves at flower bud initiation stage and grains at harvest of the two cowpea varieties were also determined using microKjeldahl method The data collected was subjected to analysis of variance and significant difference were further separated using least significant difference at P=0.05.

RESULTS AND DISCUSSION

Senescence

Table 1 compared the effects of single manure application and double manure applications on the onset and progression of senescence in the cowpea genotypes. Comparison between the treatments and the control showed that the two treatments both single and double manure dressings hastened senescence compared to the control and the difference was significant in days to 50% senescence, 90% senescence and total death of the plant.

Between the two treatments, double manure treatment (manurex2) hastened the onset of senescence and days to 50% senescence more, whereas 90% senescence and total death of plant were earlier in single manure treatment. The difference between the two treatments were however not significant at $P \leq 0.05$. Several studies reported that organic manure is not known to delay senescence, it is known to improve soil productivity and fertility which improves yield and quality of crops (Walen *et al.,* 2000; Maerere *et al.,* 2001; Vanek *et al.,* 2003). On the other hand turmeric plant was treated with cowdung manure and it remained green longer and resulted in higher vegetative growth and yield (Mazid, 1993 and Seobi *et al.,* 2005).

The result of onset, progression and duration of senescence in the two cowpea varieties, is presented in table 2. Comparison of the varieties showed that there was significant difference ($P \leq 0.05$) in all the parameters. In the variety Kannanado, there was a general delay in the number of days taken to the onset of senescence and days to 50% senescence, days to 90% senescence, and days to the total death of the plant, when compared with IT89KD – 288. Irene (2009) reported that plants that bolted early, senesced early and accumulated less chlorophyll but produce more fruits.

Effect of the two planting seasons (rainy and dry) on senescence is presented in Table 3. onset of senescence, days to 50% and 90% senescence and total death of the plants were earlier in the rainy season planting when compared with the dry season planting with significant difference ($P \geq 0.05$). That senescence was early in the rainy season than in the dry season is in line with studies by Chaudhury and Johri (2010) who showed that chlorophyll content is more in winter (October – March) than in summer (April – September). Because during winter, environmental conditions enhanced chlorophyll content, the summer and rainy seasons were period of seasonal stress, characterized by increase in chlorophyllase activity.

Nitrogen and Protein Contents of the Leaves and Grains

The nitrogen content in the leaves of the cowpea varieties is presented in table 4. It was observed that the leaves of the variety IT89KD – 288 contained more nitrogen than the leaves of Kanannado irrespective of season (i.e. rainy and dry season).

All the treatments induced greater nitrogen content compared with the control. The highest nitrogen content of the leaves was recorded in double manure treatment (manurex2) in both seasons (rainy and dry season) the least was recorded in single manure application, in both seasons. Comparison between the two seasons, nitrogen content was more in the dry season than in the rainy season (Table 4). The protein content of the leaves was higher in the variety IT89KD – 288 than in Kanannanado, while comparison between the treatment showed that protein content was higher in double manure treatment with while the least was also in single manure application but the difference was not significant.

Comparison between the two seasons showed that protein content of the leaves was found to be higher in the dry season than in the rainy season, in both varieties. (Table 5).

The nitrogen content of the grains of the cowpea varieties is presented in table 5. comparison between the 2 cowpea genotypes showed that the variety IT89KD – 288 had the highest nitrogen content than Kanannado in both seasons. The harvested grains from the treated plants had higher nitrogen content compared with the control. The treatment that stimulated the highest increase in nitrogen content was the double manure treatment while the lowest was single manure treatment. Between the two seasons nitrogen content was generally higher in the dry season than in the rainy season and the difference was significant.

Protein content of the grains was also higher in IT89KD – 288 than in Kannanado. Between the treatment double manure treatment induced greater protein content than the single manure treatment. Protein content was higher in the dry season than in the rainy season. Several studies reported that high nitrogen and protein content are more in plants treated with manure in combination with growth regulators most especially BAP, because BAP has effect on nitrogen and biomass partitioning in wheat seedlings (Sinclair *et al.,* 1975) and a perennial herb (Wagner and Beck, 1993) they also increased nitrogen levels in older leaves by promoting the accumulation of amino acids and other nitrogenous compounds in the leaves (Sheehy, 1983). High nitrogen levels by BAP and organic manure result in maintenance of high levels of Rubisco during leaf senescence (Lerbs *et al.,* 1984, Sugiharto *et al.,* 1992). They also increased nitrogen levels in older leaves by promoting the accumulation of amino acids and other nitrogenous compounds in the leaves (Omina *et al.,* 2008).

Conclusion

Both treatments (manurex1 and manure x 2) hastened senescence when compared with the control. However, double manure treatment hastened the onset of senescence and days to 50% senescence, whereas 90% and total death of the plant were earlier in single manure treatment.

However, there was significant difference between the 2 varieties in which senescence was earlier in IT89KD–28 than in Kanannando. There was also seasonal difference with regards to all the senescence parameters, senescence occurred earlier in the rainy season than in the dry season.

Nitrogen and protein content of the leaves and grains were higher in the variety IT89KD – 288 than in Kanannado, and double manure treatment induced more nitrogen and protein content than single manure treatment and also nitrogen and protein content of the leaves and grains were higher in the dry season than in the rainy season with significant difference.

Table 1: Effect of double and single manure application on senescence of 2 cowpea varieties.

Treatment	Onset of senescence	50% senescence	90% senescence	Total death
Manure	64.8	71.8	80.9	86.4
Manure x 2	62.8	71.5	81.4	87.4
Control	65.5	76.0	84.8	90.0
Mean	64.3	73.1	82.3	87.93
LSD 5 %	NS	2.378	2.515	2.356

Table 2: Comparison of senescence of two cowpea varieties

Variety	Onset of senescence	50% senescence	90% senescence	Total death
IT89KD-288	64.3	72.7	80.9	87.5
Kanannado	69.0	79.3	89.7	95.7
Mean	66.6	76.0	85.3	91.6
LSD_5%	2.92	2.279	1.382	1.217

Table 3: Effect of different planting season on senescence of two cowpea varieties.

Planting season	Onset of senescence	50% senescence	90% senescence	Total Death
Rainy	64.9	72.4	80.1	84.8
Dry	68.3	79.5	90.5	98.4
Mean	66.6	76.0	85.3	91.6
LSD 5%	3.282	3.20	3.415	2.657

Table 4: Effect of single and double manure application on nitrogen content of the leaves of two cowpea varieties at flower bud initiation stage during the rainy and dry seasons.

	Nitrogen % Rainy Season (% Dry Weight)			Nitrogen % Dry Season (% Dry Weight)		
Genotype	Control	Manure	Manure x2	Control	Manure	Manure x2
IT89KD – 288	0.68	0.72	0.79	0.99	1.11	0.12
Kanannado	0.64	0.68	0.76	0.89	1.02	1.05
Mean	0.66	0.70	0.77	0.94	1.09	1.08
LSD	0.02	0.025	0.029	0.035	0.15	0.149

Table 5: Effect of single and double manure application on protein content of the two cowpea varieties during the rainy and dry season.

	Protein % Rainy Season (% Dry Weight)			Protien % Dry Season (% Dry Weight)		
Genotype	**Control**	**Manure**	**Manure x2**	**Control**	**Manure**	**Manure x2**
IT89KD – 288	4.25	4.50	4.93	6.18	6.93	7.00
Kanannado	4.00	4.25	4.75	5.56	6.25	6.56
Mean	4.12	4.37	4.84	5.87	6.59	6.78
LSD	0.82	0.87	0.89	0.96	0.90	0.93

Table 6: The effect of single and double manure treatments on Nitrogen content of the grains of two cowpea varieties during the rainy and dry seasons.

	Nitrogen % Rainy Season (% Dry Weight)			Nitrogen % Dry Season (% Dry Weight)		
Genotype	**Control**	**Manure**	**Manure x2**	**Control**	**Manure**	**Manure x2**
IT89KD – 288	3.06	3.28	3.64	3.50	3.84	3.74
Kanannado	3.00	3.20	3.38	3.43	3.48	3.50
Mean	3.03	3.24	3.51	3.47	3.66	3.62
LSD	0.74	0.79	0.711	0.77	0.79	0.781

Table 7: The Effect of single and double manure treatment s on protein content of the grains of two cowpea varieties during the rainy and dry seasons.

	Protein % Rainy Season (% Dry Weight)			Protein % Dry Season (% Dry Weight)		
Genotype	**Control**	**Manure**	**Manure x2**	**Control**	**Manure**	**Manure x2**
IT89KD – 288	19.12	20.5	22.72	21.87	24.00	23.37
Kanannado	18.75	20.0	21.12	21.43	21.75	21.87
Mean	18.93	20.25	21.92	21.65	22.87	22.62
LSD	1.796	1.84	1.92	1.90	1.99	1.89

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