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Full Length Research paper

The approximate composition of cowpea (Vignaunguiculata (L.) Walp) grains preserved with solutions of Moringa (Moringaoleifera) seed oils and neem (Azadirachtaindica A.Juss)

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The availability, cost, safety, efficacy, and quality of bioinsecticides are the main reasons small-scale farmers utilize them to manage storage insect pests. The proximate composition of the treated grains is unknown, despite the fact that neem-moringa seed oil mixes have satisfactorily preserved cowpea grains for up to 270 days. The purpose of this study was to ascertain the approximate composition of cowpea grains that had been stored for 270 days after being treated with neem-moringa oil mixes. Cowpea was treated with theoil mixes in ratios of 1: 3 and 1: 2 neem:moringa at concentrations of 2.5 µl/g and 5.0 µl/g of cowpea grains. in the conclusion of each 90-day period, proximate composition data was gathered and statistically analyzed. The findings demonstrated that, in contrast to previous treatments, treating cowpea grains with a ratio of 1:3/2.5 and 5.0 µl/g mixture of neem-moringa seed oils had no discernible (P<0.05) impact on the proximate composition of cowpea even after 270 days of storage. According to the study's findings, a neem-moringa seed oil mixture at a ratio of 1:3/5.0µl/gg performed best in terms of its impacts on the proximate composition of the kept cowpea grains. As a result, it is advised to preserve cowpea grains for the greatest possible nutritional benefits.

Key words: Proximate composition, Moringa, Neem, Seed oils, Cowpea.

INTRODUCTION

Education Particularly in the semi-arid West Africa Savannah, the cowpea (Vignaunguiculata (L.)Walp), a significant tropical legume crop of African provenance, has become an essential component of the tropical cropping system (Asante et al., 2000). It is a drought-tolerant, heat-loving crop that requires little soil fertility (Karunasena, 2001). About 70% of the world's estimated 10 million hectares are in West and Central Africa, with Africa alone making up 7.5 million hectares of that total (Singh et al., 1996). The crop is regarded as the second most significant food grain legume and provides humans with an inexpensive source of protein. Cowpea grain is cheap and nutrient-dense. It has roughly 64% carbohydrates and 25% protein (Kormawa, 2000). It is also used as feed for animals. High-value, nutrient-dense forage is what the haulm is (ABIOTECH, 2002). In Nigeria, cowpeas rank second in importance among protein sources, after meat (Olapade et al., 2003). It is prepared simply, combined with additional items and processed into prepared meals like "akara," a deep-fat fried paste product, or "moimoi," a steamed paste. The necessity and significance of an appropriate storage system are increased by its frequent consumption. The cowpea post-production system (storage and processing) in developing nations is linked to numerous limitations, in contrast to many other crops cultivated in semi-arid tropical regions. A granary full of cowpeas can be destroyed in two or three months by postharvest pests, including weevils (ABIOTECH, 2002). The field of postharvest and storage technology is thought to be seriously challenged by this. Cowpea's nutritional value and food processing may also be impacted by insect infestation (ABIOTECH, 2002). Many populations worldwide rely on mature dried cowpeas as part of their diet (Singh et al., 1995). This legume is widely accessible, pricey, and a staple of the traditional diet. Along with cowpeas other legumes are acknowledged as significant protein sources (Agazounon et al., 2004). Grain and leaves provide β-carotene, proteins, lipids, carbs, and vitamins B and C, all of which are essential for optimum health (Enwere et al., 1998). After the grain is removed, the remaining vegetative portion of cowpea plants is used to make hay, silage, and feed for cattle (Mamiro et al., 2011). Fresh product and processed food petty trading offers rural and urban residents, especially women, the chance to make money (Singh et al., 1997). More than half of the plant protein in the human diet comes from cowpeas (Vignaunguiculata L. Walp). It offers a substantial amount of dietary lysine, which is limited in cereals, and is a rich source of calories, vitamins, and minerals. It gives both people and domestic animals food or a relatively high nutritional value in areas where there is a persistent protein shortage.Within a 270-day storage period, the study's goal was to evaluate the nutritional makeup of cowpea grains treated with ratios of 1:2 and 1:3 neem-moringa seed oils at concentrations of 2.5 µl/g and 5.0 µl/g of cowpea grains.

MATERIALS AND METHODS

The Modibbo Adama University of Technology Yola grounds provided the hand-picked neem seeds (Azadirachterindica A. Juss) used in this investigation. The Modibbo Adama University of Technology Yola campus in Adamawa state, Nigeria, and Kaltungo Local Government Area in Gombe state, Nigeria, were also sources of some of the moringa (Moringa oleifera) seeds. The plastic storage bowls were bought at Jimeta market Yola in Adamawa state, Nigeria, and the cowpea samples (ife brown) utilized came from a farm at Modibbo Adama University of Technology Yola. Cowpea grains were treated for storage using a blend of neem and moringa seed oils in 1:2 and 1:3 ratios, with a concentration of 2.5µl/g and 5.0µl/g of cowpea grains, respectively. For 270 days, the treated cowpea grains were stored at room temperature (37 oC).Data on the proximate composition of the treated and untreated (control) cowpea grain samples were gathered at the conclusion of each 90-day storage period.

The AOAC (2006) technique was used to determine the crude protein, crude fat, moisture, total ash, and crude fiber of the treated and untreated cowpea respectively. Carbohydrates were determined using the difference method. (Egan and others, 1981).

Table 1. Proximate Composition of Cowpea Grains Treated with Neem and MoringaSeed Oils Mixture

Treatment	Moisture	Ash	Fat	Fibre	Protein	Carbohydrate
Control	14.60	3.36	3.13	2.11	19.71	57.17
1:2/2.5µl/g	10.69	4.89	3.88	2.39	27.10?	51.60
1:2/5.0µl/g	11.71	4.12	3.44	1.50	22.00	57.23
1:3/2.5µl/g	10.22	3.51	3.33	1.61	19.37	61.73
1:3/5.0µl/g	11.33	3.43	3.50	1.67	19.70	60.53
Mean	11.71	3.86	3.46	1.86	21.58	57.65
LSD at 0.05	0.58	0.16	1.11	0.77	0.78	1.60
Prob. of F	<0.001	<0.001	0.732	0.116	<0.001	<0.001

RESULTS

Neem-moringa seed oil mixes' impact on the proximate composition of cowpea grains that are kept

The moisture content of cowpea grains treated with two levels of ratios 1:2 and 1:3 mixture of neem and moringa seed oils ranged from 10.22 to 14.60%, according to the results of proximate analysis (moisture, total ash, crude fat, crude fiber, crude protein, and carbohydrate) shown in Table 1. After 270 days of storage, cowpea grains treated with a ratio of 1:3/2.5µl/g had the lowest moisture level (10.22%), whereas the control sample had the greatest moisture content (14.60%). The moisture content of the samples treated with the same level of the oils, i.e. ratios 1:2/2.5 µl/g and 1:3/2.5 µl/g, did not differ significantly ($p<0.05$), nor did the samples treated with ratios 1:2/5.0 µl/g and 1:3/5.0 µl/g. However, the moisture content of the treated samples and the control (untreated cowpea grains) differed significantly ($p<0.05$).
Table 1 displays the results of the total ash content.The total ash concentration at the end of the storage periods varied between 3.36 and 4.89%. The control sample had the lowest amount of ash (3.36%), while cowpea grains treated with a 1:2/2.5µl/g ratio of neem and moringa seed oils had the greatest amount (4.89%). The control samples and the samples treated with a 1:3 neem-moringa seed oil ratio did not differ significantly ($p<0.05$). However, at the conclusion of the storage period, there were significant differences ($p<0.05$) between the ash content of the cowpea grains treated with 1:2 neem – moringa seed oils and the ash content of the untreated cowpea grains (control).
The crude fat content of the treatment and control samples did not differ significantly ($p>0.05$) (Table 1). Similarly, there were not the fiber contents of the treated cowpea grain samples and the control samples differed significantly ($p>0.05$).
Both treated and untreated cowpea grains had protein levels ranging from 19.37% to 27.10% (Table 1). The protein content of the cowpea grain samples treated with ratio 1:2 neem-moringa seed oils was considerably ($p<0.05$) higher than that of the untreated cowpea grains and those treated with ratio 1:3 neem-moringa seed oils. However, the protein content of cowpea grains treated with a 1:3 neem-moringa seed oil ratio did not differ significantly ($p<0.05$) from the control. The highest protein content was recorded by cowpea grains treated with 1:2/2.5µl/g, while the lowest protein content was recorded by cowpea grains treated with ratio 1:3/5.0µl/g (19.37%).

Table 1 shows that the range of the carbohydrate content was 51.60 to 61.73%. Cowpeas treated with a ratio of 1:3/2.5µ/g had the greatest percentage (61.73%), followed by those treated with a ratio of 1:3/5.0µl/g of neem-moringa seed oil, which had a mean value of 60.73%. Those treated with a ratio of 1:2 neem-moringa seed oils and those treated with a ratio of 1:3 neem-moringa seed oils showed significant differences ($p<0.05$). Additionally, when compared to the control and other treated samples, the carbohydrate content of cowpea samples treated with the ratio 1:2/2.5µl/g dramatically decreased.

Table 2. Effect of Storage Period on the Proximate Composition of Cowpea Grains Treated with Mixtures of Neem and Moringa Seed Oils

Period (Days)	Moisture	Ash	Fat	Fibre	Protein	Carbohydrate
90	13.08	3.18	3.24	1.60	19.32	59.60
180	9.57	4.04	3.37	1.17	20.96	61.34
270	12.48	4.36	3.77	2.80	24.45	52.03
Mean	11.71	3.86	3.46	1.86	21.58	57.65
LSD at 0.05	0.45	0.12	0.86	0.59	0.61	1.24
Prob. of F	<.001	<.001	0.438	<.001	<.001	<.001

Storage duration's impact on the proximate composition of cowpeas treated with neem and moringa seed oil mixes

The results of the impacts of storage duration on the proximate composition of cowpea treated with neem and moringa seed oil combinations are shown in Table 2. The moisture and ash contents varied significantly ($p<0.05$) over the 90, 180, and 270-day storage periods, but the fat and fiber contents of the samples stored for 90 and 180 days did not differ significantly ($p<0.05$); however, the percentage of fiber content increased significantly at the end of the 270-day storage period. Additionally, the protein composition of the samples varied significantly ($p<0.05$) throughout all examined periods. Lastly, the carbohydrate content of the samples that were kept for 90 and 180 days did not significantly differ, however there were decrease in the samples' carbohydrate content after 270 days.

Effects of storage and treatment on the proximate composition of the cowpea grains stored in different concentrations of neem and moringa seed oil mixes

Table 3 shows how the proximate composition of the stored cowpea grains is affected by storage durations and treatment with different amounts of a blend of neem and moringa seed oils. At 180 days of storage, the cowpea grains treated with ratio 1:3/2.5 µl/g had the lowest moisture content (6.47%), followed by the one treated with ratio 1:2/2.5 µl/g, which had the highest moisture content (14.20%), while at 90 days of storage, there were no discernible differences in the moisture content of the cowpea grains treated with the various ratios and concentrations. However, after being stored for 270 days, the cowpea grains treated with ratio 1:2/2.5 µl/g had the lowest moisture content (10.27%), followed by those treated with ratios 1:3/2.5 µl/g and 1:2/2.5 µl/g. Finally, the cowpea grains treated with ratio 1:2/5.0 µl/g had the lowest moisture content (13.19%). Once more, the control had the highest moisture content. With the exception of the control, where the moisture content increased steadily over the course of the storage period, the moisture content often decreased at 180 days and subsequently increased at 270 days. Cowpea grains treated with ratios of 1:2/2.5 µl/g and 1:3/5.0 µl/g recorded the highest ash content (3.21%) at 90 days of storage, followed by the cowpea grains treated with ratio 1:3/2.5 µl/g, which recorded 3.20% ash content. The effects of storage duration, neem and moringa seed oil concentration, and cowpea grains treated with different ratios on ash content were also examined. The cowpea grains treated with the ratio 1:2/2.5 µl/g and the control treatment had the lowest ash concentration (3.15%). The greatest percentage ash concentration at 180 days of storage was 5.40 for cowpea grains treated with ratio 1:2/2.5 µl/g neem and moringa seed oils, followed by cowpea grains treated with ratio 1:2/5.0 µl/g, which had 3.93. Cowpea grains treated with a ratio of 1:3/5.0 µl/g neem-moringa seed oils had the lowest % ash level (3.73) throughout this storage time. The cowpea grains treated with a ratio of 1:2/2.5 µl/g neem-moringa seed oil had the greatest ash level (6.07%) at 270 days of storage, followed by those treated with a ratio of 1:2/5.0 µl/g. However, the cowpea grains treated with ratio 1:3/5.0 µl/g neem–moringa seed oils had the lowest ash concentration (3.33%). Table 3 shows how the protein content of stored cowpea grains is affected by the storage time and the ratio of 1:2 and 1:3 neem–moringa oils at different concentrations. The highest percentage protein value (20.23%) was found in cowpea grain treated with ratio 1:2/2.5 µl/g after 90 days of storage. This was followed by one treated with ratio 1:3/5.0 µl/g, which had a percentage protein content of 20.01%.Cowpea grains treated with a 1:2/5.0 µl/g ratio of neem–moringa oils had the lowest protein content. The maximum protein level (29.56%) was found in cowpea grains treated with a ratio of 1:2/2.5 µl/g neem–moringa seed oils after 180 days of storage. These grains treated with a ratio of 1:3/5.0 µl/g had a protein content of 19.08%. The cowpea grains treated with a ratio of 1:3/2.5 µl/g had the lowest protein concentration. After 270 days of storage, the similar pattern was noted. The cowpea grains treated with ratio 1:2/5.0 µl/g neem-moringa oils had the highest amount of carbohydrates (61.36%) at 90 days of storage, followed by the cowpea grains treated with ratio 1:3/2.5 µl/g, which had 60.42%, and the cowpea grains treated with ratio 1:2/2.5 µl/g neem-moringa seed oils, which had the lowest amount (57.83%).

Table 3.Interaction between Storage Period andVarying Concentration of Mixture of Neem and Moringa Seed Oils on the Proximate Composition of Cowpea Grains

Period (Days)	Control	Neem : Moringa Seed Oil Ratios				Mean	LSD at 0.05	Prob. of F
		1:2/2.5µl/g	1:2/5.0µl/g	1:3/2.5µl/g	1:3/5.0µl/g			
	Moisture							
90	13.20	13.27	13.00	13.13	12.80			
180	14.20	8.53	8.93	6.47	9.73			
270	16.40	10.27	13.19	11.07	11.47	11.71	1.01	<.001
	Ash							
90	3.13	3.21	3.15	3.20	3.21			
180	3.33	5.40	3.93	3.80	3.73			
270	3.60	6.07	5.27	3.53	3.33	3.86	0.28	<.001
	Protein							
90	19.58	20.23	18.32	18.43	20.01			
180	18.51	29.56	19.13	18.54	19.08			
270	21.03	31.52	28.55	21.15	20.00	21.58	1.35	<.001
	Carbohydrate							
90	59.25	57.83	61.36	60.42	59.14			
180	59.29	52.84	63.67	67.03	63.86			
270	52.97	44.15	46.66	57.75	58.60	57.65	2.78	<.001

The maximum carbohydrate content (67.03%) was found in cowpea grains treated with a ratio of 1:3/5.0 µl/g neem-moringa oils after 180 days of storage and storage combined with neem-moringa seed oil treatment (1:3/2.5 µl/g).

This showed 63.83% carbohydrate content. Conversely, the cowpea grains treated with a 1:2/2.5µl/g ratio of neem-moringa oils had the lowest carbohydrate content (52.84%). The maximum carbohydrate content (58.60%) was recorded by cowpea grains held for 270 days and treated with ratio 1:3/5.0µl/g neem-moringa oils. These were followed by those treated with ratio 1:3/2.5µl/g, and the lowest carbohydrate content (44.15%) was recorded by cowpea grains treated with ratio 1:2/2.5µl/g.

DISCUSSION

The removal of water with oil absorption into the seeds may be the reason for the significantly ($p<0.05$) lowest moisture content loss from the cowpea sample treated with ratio 1:3/2.5 µl/g neem-moringa seed oil. This is demonstrated by the fact that the control samples had the greatest moisture content (14.60%) of any treated samples. This outcome is in line with the findings of Gayan et al. (2006), who examined the impact of certain essential oils on the physicochemical alterations of cowpeas that were stored and treated to prevent Callosobruchus maculatus cowpea bruchids. Given that the control samples were more vulnerable to bruchid infestation than the other samples, the outcome could possibly be the result of increased insect population and metabolism absorbing moisture from the atmosphere. According to the distinctive smell found in these samples, the absorption of the treated mixture of neem and moringa seed oils into the cowpea grains in trace amounts may be the cause of the increase in the total fat content over the storage period of the cowpea grains treated with these oils. This outcome is also equivalent to Gyan et al. (2006)'s findings.
There was no discernible difference in the protein content between the control and treated samples with ratios of 1:3/2.5 µl/g and 1:3/5.0 µl/g. This could be because, although there were a lot of insects and their eggs in the control samples, the insects were successfully managed in the treated samples. This outcome is consistent with the findings of Gayan et al. (2006). Given that that amount of oil could not preserve the cowpea grain samples for more than 180 days, the significantly higher protein contents (27 and 22%) of samples treated with ratios 1:2/2.5 and 1:2/5.0 µl/g may be the result of numerous C. maculatus eggs and larvae on the cowpea grains as a result of infestation (Ilesanmi and Gungula, 2010). Similar findings were reported by Danjumma et al. (2009), who discovered that as the degree of wheat infestation rose, there was a progressive rise in total nitrogen, total protein, non-protein, and uric acid. Both untreated, non-infested grains and samples treated with ratios of 1:3/2.5 µl/g and 1:3/5.0 µl/g neem-moringa seed oils showed no change in total protein content (as determined by its nitrogen content) after storage. The fact that C. maculates hollowed out the majority of endosperm, leaving just the seed coat, which is primarily composed of fiber, may be the cause of the increase in fiber content seen in the infested cowpea grains (1:2/2.5 µl/g treated). This is consistent with the findings of Bamaiyi et al. (2006) and Danjumma et al. (2009).
The ash content of samples treated with ratios of 1:2/2.2 and 1:2/5.0 µl/g neem-moringa increased significantly, suggesting that the more infested the cowpea grain sample, the lower the volume and concentration of moringa oil in the oil treatment mixture. Additionally, as highlighted by Gayan et al. (2006), the amount of seed coat that remains increases with the amount of endosperm consumed. This component is rich in ash.
Given that the majority of carbohydrates are found in the endosperm section of cowpea grains and that these oil levels protected the grains from infestation, it is possible that the sample treated with ratios 1:3/2.5 and 5.0 µl/g had the highest carbohydrate content (60.53–61.73%). This outcome is in line with Ojimelukwe et al.'s (1999) findings on how infestation affects cowpea's nutritional content and physicochemical characteristics.
There was no significant difference ($p<0.05$) in the moisture content of the treated cowpea and the control sample at the end of 90 days of storage, but it did decrease at the end of 180 days and then increase at the end of 270 days. This variation may have been caused by changes in the relative humidity (RH) of the environment during the storage period, according to the mean effect of storage period on the percentage proximate composition of cowpea grains treated with a mixture of neem and moringa seed oils. The first ninety days had an average relative humidity (ARH) of 94.34 from August to November, followed by 72.88 from November to February and 80.70 from March to May. This outcome is in line with earlier research by Ilesanmi and Gungula (2010), who preserved cowpea using a combination of neem and moringa seed oils at different doses. According to Anderson and Alcock (2013), the treated samples provided the safest moisture level for grain storage, which was between 10 and 12 percent. This is below the essential moisture value for grains, which is 14%. This can be the result of water being removed and oils being absorbed by the grains. Even though the relative humidity was high, the oil may have formed a moisture barrier for the cowpea grains while they were being stored. The ash content range of 3.18 to 4.36% is consistent with the findings of Owolabi et al. (2012), who examined the mineral composition, proximate, and antinutrition of five types of improved and local cowpea. Additionally, it aligns with the findings of Pandey and Westphal (1989), who documented the chemical makeup of cowpea grain. This variation could be the result of a weevil infestation, in which the weevils consumed the grain, leaving behind primarily the seed coat, which contains the chaff, which is equivalent

to ash. The number of mineral components in the sample can be determined by looking at the ash content. The fat content results for both treated and untreated cowpea samples, which range from 3.24 to 3.77, are similarly consistent with Owolabi et al. (2012)'s findings. The percentage fiber content, which ranges from 1.17 to 2.80%, is consistent with the findings of Aremuet al. (2006) and Owolabi et al. (2012), who conducted a comparative analysis of the chemical and amino acid composition of a few underutilized legume flours in Nigeria.After 270 days of storage, the sample treated with a ratio of 1:2/2.5 µl/g contained 2.39% fiber. This could be the result of a weevil infestation, which left behind seed coat, which increased the amount of fiber because the cowpea endosperm had been eaten out. This could indicate that the oil's concentration (1:2/2.5 µl/g) was insufficient to stop infection for up to 270 days. This result is in line with a study by Ilesanmi and Gungula (2010) that found that after 180 days of storage, 44% of cowpea treated with a 1:2 ratio of neem to moringa seed oils were infested. This could explain why, after 180–270 days, the % protein content of samples treated with a 1:2 mixture of neem and moringa seed oils increased. Given how high in protein they are, Callosobruchus maculatus eggs and larvae may have contributed to the higher protein content. The study's control and all other treated samples had protein values that were consistent with the findings of Pandey and Westphal (1989), Henshaw (2008), Oyeyinka et al. (2013), Owolabi et al. (2012), and Carvalho et al. (2012). The decrease in percentage carbohydrate content in cowpea grain samples treated with a 1:2 mixture of neem and moringa seed oils at the end of the 270-day study may not have been caused by the oil; rather, it may have resulted from weevils eating up the grain endosperm and the protein content increasing.

The percentage proximate composition of store cowpea was found to be affected by the combination of neem and moringa seed oils and storage period. At 90 days of storage, there was no discernible difference between the moisture content of the treated and control (untreated) cowpea grain samples; however, at 180 to 270 days of storage, the moisture content of the control samples was significantly ($p<0.05$) higher (14.20 and 16.20%) than that of the treated samples, which ranged between 6.5 and 11.5%. This is consistent with the findings of Gyang et al. (2006), who suggested that the removal of water from the oil-treated samples may have resulted from the oil's absorption into the grains. They also noted that the higher moisture content of the control samples might have resulted from the increased population and metabolism of insects absorbing moisture from the atmosphere.

The ash content of the control and treated cowpea grain samples did not differ significantly ($p<0.05$) at 90 days of storage; however, after 180–270 days, a notable increase in the ash content of samples treated with a 1:2 mixture of neem and moringa seed oils was noted. The seed coat of cowpea grains contains a lot of this substance. Thus, a significant infestation of cowpea bruchids, which ate the endosperm portion of the grains and left behind the seed coat, which is high in ash component, may be the cause of the increase in this feature. At the end of 180 and 270 days of storage, the protein content of cowpea treated with a 1:2 mixture of neem and moringa seed oils showed a similar trend, with a significant increase. This could be due to bruchid eggs and larvae, which are highly protein-rich insects. With regard to carbohydrate content, the trend was marginally different. The carbohydrate content of the treated cowpea and the control did not differ significantly ($p<0.05$) after 90 days of storage; however, after 270 days, all cowpea grains showed a significant decrease in carbohydrate content, with the exception of the sample treated with a 1:3 mixture of neem and moringa seed oils. Since carbohydrates are concentrated in the endosperm region of the grains, the loss may be caused by both bruchid consumption of the cowpea endosperm and an increase in the protein content of the samples. As storage time increased, the amount of carbohydrates dropped. This outcome is consistent with the findings of Danjumma et al. (2009) about the nutritional makeup of maize grains that were prepared and stored using plant powders. According to Ilesanmi (2009), the degree of bruchid infestation in cowpea grain samples treated with a 1:2 mixture of neem and moringa seed oils at the end of 270 days as compared to cowpea samples treated with a 1:3 mixture of neem and moringa oil at the end of 180 days of storage may be the reason for the significant increase in percentage protein, ash, and fiber contents and the significant decrease in percentage carbohydrate content. The low concentration of moringa oil, which translates to reduced behenic acid (the active element in moringa oil), may be the cause of the high level of infection for samples treated with a 1:2 neem-moringa oil ratio. Most likely, this concentration is insufficient to stop an infection that lasts more than 180 days. When compared to the control, the analysis demonstrates that there is no discernible difference ($p<0.05$) in the proximate composition of any of the samples treated with ratio 1:3 at either level. This result is consistent with that of Ilesanmi and Gungula (2010), who used a combination of neem and moringa seed oils to preserve cowpea grains.

CONCLUSION AND RECOMMENDATION

The study found no negative effects on the proximate of the cowpea grains when cowpea samples were stored with a 1:3 mixture of neem and moringa seed oils.To maximize the nutritional value of cowpea grains and their products, a 1:3 blend of neem and moringa seed oils, namely 1:3/5.0µl/g, should be utilized for cowpea grain preservation.

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