



EFFECT OF COW DUNG AND COW URINE COMBINATION FOR THE CONTROL OF COWPEA FIELD PESTS IN BAUCHI STATE, NIGERIA

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ABSTRACT

Field trial was conducted during the rainy season of 2024 at Abubakar Tafawa Balewa University, Teaching and Research Farm Bauchi, to investigate the effect of cow dung and cow urine combination for the control of cowpea field pests. The treatments consisted of three (3) rates of cow dung + cow urine (2.5, 5.0 and 7.5 l/ha), 2% Acetamiprid + 1.5% Lambda cyhalothrin EC (1 l/ha) and a control. These were combined to give 5 treatments, laid out in a randomized complete block design and replicated three times. The result revealed a significant difference ($P \leq 0.01$) among the treatments on number of aphids per plant, proportion (%) of plants infested by aphids, number of maruca larva per flower, proportion of flowers infested by larva, number of damaged pods, number of clavigralla per plants, number and percentage of shriveled pods. The result also showed that cowpea treated with either cow dung + cow urine (7.5 l/ha) or 2% Acetamiprid + 1.5% Lambda cyhalothrin had the lowest number of aphids, maruca and clavigralla infestation. Control plot on the other hand, had the highest proportion of plants infested by aphids, maruca as well as clavigralla. Yield and yield components on the other hand, cowpea treated with either cow dung + cow urine (7.5L/ha) or 2% Acetamiprid + 1.5% Lambda cyhalothrin had the highest number of seeds per pod and highest grain yield (913.23 kg/ha and 927.10 kg/ha). Cow dung and cow urine combination had significantly impacted cowpea yield and insect pest infestation, therefore, it is recommended to treat cowpea with 7.5 l/ha cow dung and cow urine combination for the control of cowpea field pests and higher yield.

Keywords: Cow, Dung, Urine, Pest, Field, Cowpea.

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp) is a vital legume crop extensively cultivated in sub-Saharan Africa, particularly in Nigeria, which is among the leading producers globally. It serves as a significant source of protein for human consumption and provides nutritious fodder for livestock. Cowpea is a significant source of protein, calories, and micronutrients. It is a valuable crop for soil fertility improvement, as it fixes atmospheric nitrogen through symbiotic relationships with rhizobia (Kumar *et al.*, 2020). Globally, cowpea production is estimated to be around 6 million metric tons, with Africa accounting for over 70% of global production.

Despite its importance, cowpea production faces substantial challenges from various insect pests, leading to significant yield losses. Key pests include: Aphids (*Aphis craccivora*): These sap-sucking insects cause direct damage by feeding on plant sap and indirectly by transmitting viral diseases. Legume Flower Thrips (*Megalurothrips jostedti*): They damage flowers, leading to reduced pod formation. Legume Pod Borer (*Maruca vitrata*): This pest feeds on flower buds, flowers, and young pods, causing yield losses ranging from 20% to 80% if uncontrolled. Pod-Sucking Bugs (e.g., *Clavigralla tomentosicollis*): They pierce pods, leading to seed damage and reduced quality. These pests can cause up to 70% grain yield reduction in cowpea if not effectively managed.

Cowpea is susceptible to various insect pests, including: Aphids (*Aphis craccivora*): These small, soft-bodied insects feed on plant sap, causing curled or distorted leaves. Thrips (*Megalurothrips jostedti*): Thrips are tiny, insects that feed on plant sap, causing stunted growth and distorted leaves. Pod borers (*Maruca vitrata*): These caterpillars feed on cowpea pods, causing significant yield losses (Oghiakheet *et al.*, 2019). Flower thrips (*Frankliniella occidentalis*): These thrips feed on cowpea flowers, reducing seed set and yield (Annan *et al.*, 2019).



Synthetic insecticides have been widely used to control cowpea insect pests due to their efficacy and rapid knockdown effects. However, the over-reliance on synthetic insecticides has led to concerns about environmental pollution, human health risks, and the development of pesticide-resistant pest populations (Kumar *et al.*, 2020). Moreover, the high cost of synthetic insecticides can be a significant burden for smallholder farmers in developing countries. In recent years, there has been a growing interest in exploring alternative pest management strategies that are environmentally friendly, sustainable, and cost-effective. One promising approach is the use of botanicals or organic amendments, such as cow dung and cow urine, which have been shown to possess insecticidal properties (Rathoreet *al.*, 2021). Cow dung and cow urine are readily available, inexpensive, and biodegradable, making them attractive options for smallholder farmers. Several studies have demonstrated the efficacy of cow dung and cow urine in controlling various insect pests, including aphids, whiteflies, and beetles (Kumar *et al.*, 2022; Singh *et al.*, 2020). However, there is limited research on the use of cow dung and cow urine for controlling cowpea insect pests, particularly on different cowpea varieties. This study aims to investigate the effectiveness of cow dung and cow urine in controlling insect pests on two varieties of cowpea, with a view to developing a sustainable and eco-friendly pest management strategy.

MATERIALS AND METHODS

Study Area

The research was conducted at the Abubakar Tafawa Balewa University Teaching and Research Farm Bauchi. The experiments were carried during the rainy season of 2024. Bauchi is located at 10° 74'E latitude and 9°47'E and situated at 690.3m above sea level in savannah zone of Nigeria.

Collection and Preparation of Cow Dung and Cow Urine

Cow dung and cow urine were collected from Abubakar Tafawa Balewa University Farm Bauchi, dried under shade. Cow dung of about 5kg was diluted in to 5L of water and 5L of cow urine was added.

The resulting solution was fermented for four days in an enclosed container in a shaded area and then 100g of lime was added neutralize the toxic phenols and acid released.

Treatments and Experimental Design

The treatment consisted of cow dung+cow urine (2.5L/ha, 5.0L/ha and 7.5L/ha), 2.5%Acetamiprid+1.5%Lamdacyhalothrine EC (1L/ha) and zero application (control). These were combined to give five treatment combinations, randomized and replicated three times. The experiment was laid out in Randomized Complete Block Design (RCBD).

Land Preparation and Field Layout

The land was cleared, ploughed and then harrowed into fine tilt soil and levelled flat. It was then marked into three blocks each containing ten plots. Each plot measured 9m². A path of 0.5m and 1m was allowed within and between blocks respectively, the boundary of each plot was demarcated by ropes and sticks, tagged with its treatment number. The total area of the land used was 392m². Seeds were sown as per treatment at 25x75cm spacing, two seeds were sown per hole and later thinned to one plant per stand, the land was kept weed free by manual weeding.

Application of Treatments

The cow dung+cow urine were applied at the rate of 2.5L/ha, 5.0L/ha and 7.5L/ha weekly. The Acetamiprid2%+Lamdacyhalothrine1.5% was applied biweekly according to the manufacturer's instruction at the rate of 1.0L/ha

Data Collection

Data were collected from 10 randomly tagged plants at various stages of the plant growth on the following parameters;

Aphis craccivora

Infestation was assessed in the morning between 8 and 10 a.m., from the two middle rows of each plot at the age of 2 weeks for aphid colony. The size on each stand was counted visually. Six weekly observations were made



Maruca vitrata

Infestation of cowpea flowers by *Maruca* was assessed by counting in the field between 3 and 5 p.m. The presence of holes and larva on the flowers were the *Maruca* damage index. Ten flowers in the two outer rows of each plot were chosen randomly, carefully opened and examined on the spot. There were five observations at 5 days' intervals.

Clavigralla tomentosicollis

Population of PSBs which rested on cowpea stands in the two middle rows were counted weekly, between 8 and 10 a.m. at the age of six weeks. Four observations were made

Number of Damaged Pods

These were visually scored in the field when the pods were filled, matured but still green. Pod damaged was visually rated. The presence of holes and frass on pods and sticking together of pods were used as *Maruca* damage

Number of Shriveled Pods

These were also visually scored in the field when the pods were filled, matured but still green. Pod that were deformed, discoloured and or dried prematurely were counted and were used as *Clavigralla* damage.

Number of Pods/plant

Number of pods per plant were counted from the tagged plants and the mean number of pods/plant was recorded

Number of Seeds/pod

Number of seeds in each pod of the tagged plants were counted and the mean number of seeds/pod was recorded

Grain Yield(kg/ha)

The data was collected by weighing the grains in each plot after threshing using measuring scale and was calculated in kg and then projected per hectare.

Data Analysis

All the data collected were subjected to analysis of variance (ANOVA) to test the level of significant of all the treatment. Duncan's Multiple Range Test (DMRT) was adopted to separate significantly different treatment means

RESULTS AND DISCUSSION

Effect of Cow Dung and Cow Urine Combination on Aphid (*Aphis craccivora*) Infestation

Table 1 presents result of the influence of cow dung + cow urine treatments on *Aphis craccivora* (aphid) infestation in cowpea. The results indicated a significant difference ($P \leq 0.01$) in both the number of aphids per plant and the percentage of plants infested across the treatments. Both 2.5% Acetamiprid + 1.5% Lambda-cyhalothrin and 7.5 L/ha cow dung + cow urine significantly reduced aphid infestation. Conversely, untreated cowpea plots recorded the highest aphid population and infestation rate. Among all treatments, synthetic insecticide application recorded the lowest aphid infestation, closely followed by the organic cow dung + cow urine mixture at 7.5 L/ha.

The efficacy of both synthetic and organic treatments in suppressing aphid populations confirms their potential as key components of integrated pest management (IPM). The active ingredients in Acetamiprid and Lambda-cyhalothrin disrupt the nervous system of aphids, causing rapid knockdown and mortality. Meanwhile, cow dung and cow urine contain natural compounds with insect-repellent and anti-feedant properties, which can either repel aphids or inhibit their feeding and reproduction. Moreover, organic treatments may improve plant vigor, enhancing tolerance to pest pressure.

Importantly, the fact that 7.5 L/ha of cow dung + cow urine reduced aphid infestation almost as effectively as the synthetic insecticide underscores the practical value of organic formulations in pest control, especially in low-resource settings. This finding is consistent with the study by Yusuf *et al.* (2019), who demonstrated that animal waste-based treatments significantly reduced aphid populations in cowpea fields.

Table 1: Effect of Cow Dung and Cow Urine Combination on Aphid (*Aphis craccivora*) Infestation

TREATMENTS	No. of Aphids/plant	%(proportion) of plants infested by Aphids
INSECTICIDE(L/HA)		
Control	5.67 ^a	38.83 ^a
CD+CU-2.5	5.75 ^a	22.42 ^b
CD+CU-5.0	4.75 ^b	9.08 ^c
CD+CU-7.5	3.58 ^c	5.42 ^{cd}
Chemical-1.0	2.92 ^c	3.00 ^d
LS	**	**
SE±	0.250	1.673

Means followed by different letter within the same column are significantly different using DMRT. LS:Level of Significance, CD+CU:cowdung+cow urine, Chemical: 2.5%Acetamiprid+1.5%Lamdaacyhalothrine EC, **: Significant at 0.01%

Effect of Cow Dung and Cow Urine Combination on Cowpea Pod Borer (*Maruca vitrata*) Infestation Table 2 shows results of the influence of cow dung + cow urine treatments on the infestation level of the cowpea pod borer (*Maruca vitrata*). The results revealed that there was significant difference ($p \leq 0.01$) between the insecticide treatments. The infestation level measured by the number of larvae per flower, proportion of flowers infested, and number of damaged pods was considerably higher in untreated cowpea plots. In contrast, the lowest *M. vitrata* infestation was recorded in plots treated with the chemical insecticide (1 L/ha), followed by plots treated with cow dung + cow urine at 7.5 L/ha.

The superior performance of both the synthetic insecticide and the cow dung + cow urine treatment in reducing *M. vitrata* infestation underscores the effectiveness of external control measures. While synthetic insecticides directly disrupt the nervous system of the larvae, cow dung and cow urine may act through a combination of repellent, antifeedant, and oviposition-detering properties, discouraging the pest from colonizing flowers and pods. This finding supports the work of Usman *et al.* (2021), who found that organic formulations based on animal waste reduced pod borer infestation significantly when applied at appropriate concentrations.

Notably, the effectiveness of the 7.5 L/ha cow dung + cow urine treatment in reducing infestation to levels comparable to synthetic insecticides demonstrates its potential as a sustainable and environmentally friendly option for *M. vitrata* management. Its affordability and ease of preparation make it particularly suitable for smallholder farmers who may lack access to commercial insecticides.

Table 2: Effect of Cow Dung and Cow Urine Combination on Cowpea Pod Borer (*Maruca vitrata*)

TREATMENTS	No. of M.Vitrata larvae per Flower	%(proportion) of flowers infested by larva	No.of damaged pods
INSECTICIDE(L/HA)			
Control	25.92 ^a	63.58 ^a	3.81 ^a
CD+CU-2.5	15.67 ^b	38.92 ^b	3.06 ^b
CD+CU-5.0	5.83 ^c	29.00 ^c	2.62 ^c
CD+CU-7.5	3.00 ^d	15.50 ^d	1.83 ^d
Chemical-1.0	2.08 ^c	7.67 ^c	1.09 ^c
LS	**	**	**
SE±	0.158	0.271	0.042

Means followed by different letter within the same column are significantly different using DMRT. LS: Level of Significance, CD+CU:cowdung+cow urine, Chemical: 2.5%Acetamiprid+1.5%Lamdaacyhalothrine EC, **: Significant at 0.01%



Effect of Cow Dung and Cow Urine Combination on Cowpea Pod Sucking Bug (*Clavigralla tomentosicollis*) Infestation

Table 3 presents the result on effect of pest control treatments on the infestation level of the cowpea pod sucking bug, *Clavigralla tomentosicollis*. The results revealed that there was significant difference ($p \leq 0.01$) among insecticide treatments. The number of *C. tomentosicollis* per plant, the number of shriveled pods, and the proportion of shriveled pods were highest in untreated cowpea plots. In contrast, the lowest infestation levels were recorded in plots treated with the chemical insecticide (1 L/ha), followed by those treated with cow dung + cow urine at 7.5 L/ha.

Cow dung and cow urine applied at 7.5 L/ha also reduced bug populations and pod damage, likely due to their repellent odor, physical interference with pest attachment, or anti-feedant compounds present in the mixture. The reduction in the number of shriveled pods in treated plots, especially with the organic input, suggests that cow dung and urine not only deterred insect feeding but also allowed uninterrupted pod filling and development. This supports the report of Yusuf *et al.* (2019), who found that cow dung and urine reduced damage from pod sucking pests and improved pod quality and seed recovery in cowpea.

Table 3: Effect of Cow Dung and Cow Urine Combination on Cowpea Pod Sucking Bug (*Clavigralla tomentosicollis*) Infestation

TREATMENTS	No.ofC.Tomentosicollis per plant	No.of shriveled pods	% proportion of shriveled pods
INSECTICIDE(L/HA)			
Control	4.01 ^a	1.76 ^a	17.85 ^a
CD+CU-2.5	3.53 ^b	1.35 ^b	10.32 ^b
CD+CU-5.0	3.15 ^c	1.17 ^c	7.45 ^c
CD+CU-7.5	1.87 ^d	0.92 ^d	4.75 ^d
Chemical-1.0	0.99 ^e	0.65 ^e	3.17 ^e
LS	**	**	**
SE±	0.033	0.042	0.249

Means followed by different letter within the same column are significantly different using DMRT. LS: Level of Significance, CD+CU:cowdung+cow urine, Chemical: 2.5%Acetamiprid+1.5%Lamdacyhalothrine EC, **: Significant at 0.01%

Effect of Cow Dung and Cow Urine Combination on Yield and Yield Components of Cowpea Table 4 presented result of the effects of application of cow dung + cow urine and insecticides on yield and yield components of cowpea. The measured parameters include number of pods per plant, number of seeds per pod, pod length, and grain yield. The result revealed that all the components pods per plant, seeds per pod, pod length, and grain yield were significantly ($p \leq 0.01$) higher in cowpea treated with cow dung + cow urine (7.5 L/ha) or 2.5% Acetamiprid + 1.5% Lambda-cyhalothrin. Untreated cowpea produced the lowest yield and yield components.

The effectiveness of both chemical and organic treatments in enhancing yield and its components is linked to their role in insect pest suppression. Reduced pest pressure particularly from flower- and pod-feeding insects like *Maruca vitrata* and *Clavigrallatomentosicollis* allows the cowpea plants to retain more flowers and fill more pods, leading to higher seed set and grain output. Moreover, cow dung and cow urine may have provided supplemental nutrients that further improved plant vigor and reproductive output. This dual action pest suppression and nutrient supply was also demonstrated by Usman *et al.* (2021), who noted improved pod and grain yield in cowpea treated with organic waste formulations.

Interestingly, the organic treatment at 7.5 L/ha performed comparably to synthetic insecticide, suggesting its viability as a low-cost and eco-friendly alternative for smallholder farmers. This observation confirms earlier findings by Akinbode *et al.* (2018), who reported similar grain yield responses in cowpea under organic and chemical pest control regimes.

Table 4: Effect of Cow dung and Cow Urine combination on Yield and Yield components of Cowpea

TREATMENTS	No. of pods Per Plant	No. of seeds Per Pod	Pod length(cm)	Grain Yield(kg/ha)
INSECTICIDE(L/HA)				
Control	8.33 ^c	7.83 ^d	12.00 ^d	402.50 ^d
CD+CU-2.5	11.67 ^d	10.92 ^c	13.00 ^c	552.92 ^c
CD+CU-5.0	13.92 ^c	11.92 ^b	14.00 ^b	636.70 ^b
CD+CU-7.5	17.33 ^b	13.67 ^a	15.00 ^a	913.23 ^a
Chemical-1.0	18.75 ^a	14.17 ^a	15.08 ^a	927.10 ^a
LS	**	**	**	**
SE±	0.194	0.236	0.158	10.687

Means followed by different letter within the same column are significantly different using DMRT. LS: Level of Significance, CD+CU: cow dung + cow urine, Chemical: 2.5% Acetamiprid + 1.5% Lambda cyhalothrin EC, **: Significant at 0.01%

CONCLUSION AND RECOMMENDATION

The findings of this study clearly indicated that: Cow dung + cow urine at 7.5 L/ha was highly effective in both reducing field pest infestation and enhancing plant performance, showing comparable results to synthetic insecticide. The integration of affordable, locally available organic inputs such as cow dung and cow urine can significantly reduce reliance on synthetic insecticides while maintaining productivity. For effective insect pest management and enhanced yield, cowpea farmers especially in northern Nigeria are advised to apply cow dung + cow urine at 7.5 L/ha, this organic insecticide formulation should be promoted as a cost-effective, environmentally friendly alternative to chemical insecticides in low-resource farming communities.

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