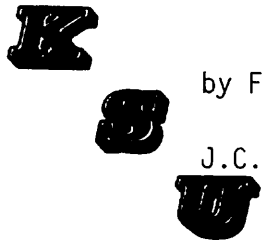

Performance of Weanling Pigs as Influenced by Feeding Insect- and Fungal-damaged Grain Sorghum

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Summary

Using 128 crossbred pigs with an average initial weight of 18.3 Kg, we determined the effect that insect- and fungal-damaged sorghum would have on the pigs' performance. No differences were found in daily feed consumption for any treatment during a 28-day feeding trial. Average daily gains and feed efficiencies were similar to those of the control for pigs fed grain sorghum that had been damaged by lesser grain borer; red beetle; a mixture of lesser grain borer, flat grain beetle, and indian meal moth; or Aspergilas Candidus. Pigs fed grain sorghum damaged by rice weevil showed lower average daily gains and a higher feed-to-gain ratio than did the controls. Aspergilas Glaucus-damaged grain showed similar ADG, but a significantly poorer F/G during the first 14 days, but not during the second half of the study.

Even though insect damaged grain appears to be nutritionally adequate rather significant losses of dry matter and energy are sustained when grain sorghum is allowed to go out of condition. Up to 6% of the gross energy and approximately 5% of the crude protein content was lost to infestation or fungal invasion.

Introduction

For many years the destruction of feed grains by insects and fungi has been of great concern to the grain and feed industry. Though much work has been done on toxins produced by these storage pests, little is known about the feeding value of grains damaged by infestations or by nontoxin-producing fungal species. Our objective was to determine how young pigs would perform if fed grain sorghum damaged by certain insects and fungi. The young pigs were used, because at that age animals generally respond more to differences in palatability and utilization than do older animals, particularily when quality of the grain is involved.

Experimental Procedure

One hundred twenty-eight crossbreed pigs with an average initial weight of 18.3 Kg were randomly assigned to 32 pens by sex and weight, giving four replicates of eight dietary treatments. Pigs were housed four per pen (2 males and 2 females) in an environmentally controlled, slatted-floor nursery and were weighed every 14 days. Diet formulations used are

shown in Table 8. Grain sorghum from infested lots replaced the control grain on a weight-for-weight basis. These grain sorghum treatments were used in this study:

1. Control - no insect or fungal damage.
2. Lesser grain borer infested at 1 adult per 100 g of grain (LGB).
3. Rice weevil infested at 1 adult per 100 g of grain (RW).
4. Red flour beetle infested at 1 adult per 100 g of grain (REB).
5. Lesser grain borer infested at 1 adult per 200 g of grain plus flat grain beetle infested at 1 adult per 100 g of grain plus indian meal moth inoculated at 1 egg per 100 g of grain (Mixture).
6. Asperigilus Glaucus inoculated grain (AG).
7. Aspergilus Candidus inoculated grain (AC).

Bins of these treatments were stored at 23°C for 4 months to insure adequate damage.

Table 8. Diet Formulation for Damaged Grain in Swine Study

Ingredient (%)	Diet
Grain sorghum[a]	74.85
Soybean meal	22.00
Dicalcium phosphate	.75
Limestone	1.15
Salt	.25
Vitamin mineral premix	1.00

	Control	LGB	RW	RFB	Mixture	AG	AC
Dry matter	88.8	88.4	88.8	88.7	88.3	88.1	88.2
Crude protein[b] (%)	19.5	19.7	19.3	20.1	19.4	19.4	19.7
Gross energy (Kcal/Kg)	3910	3883	3886	3936	3896	3908	3824

[a]Control grain sorghum was replaced wt./wt. with damaged grain from each treatment.

[b]Crude protein and gross energy reported on dry basis.

Results and Discussion

The condition of the grain after 4 months of storage is shown in Table 9. The moisture content of the insect-damaged grain was not significantly altered during storage. The moisture content of each of the fungal-damaged lots was significantly higher than that of the control after 4 months, but did not differ from the initial moisture content. In all treatments, test weight of the grain sorghum was lower than that of the control, quite likely due to the broken and damaged kernels present. The amount of fine material (through 3/64 triangular screen) and of visual

damage present were directly correlated. In the fungal-damaged grains, the predominant organisms present were A. Glaucus or A. Candidus.

Table 9. Condition of Grain Sorghum Stored 4 Months

	TREATMENT						
	Control	RFB	RW	LGB	Mixture 2	AG	AC
Moisture %	13.0	13.7	13.8	13.3	13.2	14.5	16.0
Test weight (lb/bu)	59	58	58	55	55	56	55
Fine material %	6.6	8.3	7.0	12.5	13.3	12.2	11.7
Infested kernels %	5.0	35.7	45.7	60.2	55.8	----	----
Invaded kernels %	----	----	----	----	----	78	80
Dominant organism	----	----	----	----	----	A. Glaucus	A. Candidus
Germination %	97	20	15	10	12	10	10

Table 10 shows the effect that damaged grain sorghum had on the average daily gain (ADG), feed efficiency, and daily feed intake of young pigs. During the first 14 days of the study, the RW treatment was the only one significantly different from the control only in ADG. All diets did result in a numerically lower ADG than that of the control, except for the one with the LGB, damaged grain which showed a slightly improved ADG. Looking at the feed-to-gain ratio (F/G) for this same time period reveals that the rice weevil-damaged and Asperigilus Glaucus-damaged grain resulted in a significantly ($P<.05$) poorer F/G ratio than did the control. The remainder of the treatments showed poorer F/G ratios than that of the control. The daily feed intake, which is somewhat indicative of the palatability of the diets, did not differ significantly ($P<.05$) for the first 14 days of the study; however, the LGB, Mixture and AG treatments resulted in higher intake, whereas RW and RFB reduced intake. That indicated that palatability was not a problem with the LGB, Mixture, AG, and AC treatments, but might have been with the RW and RFB treatments.

For the second half of the study and for the entire 28 days, ADG in no treatment except the RW differed significantly from that of the control, though during the second 14 days of the study ADG was numerically better than the control in all treatments. The feed efficiency during the last 14 days was significantly poorer for the RW and numerically poorer for the LGB and RFB treatments than that of the control. The Mixture, AG, and AC treatments showed numerically better F/G ratio's than did the control. The average daily feed intake was not significantly different during this phase, but all treatments did show a higher feed intake than the control did. Therefore, it can be assumed that any palatability problems that might have existed during the first 14 days was eliminated by the end of the study.

Comparing the results over the entire 28 days of feeding reveals that only the RW treatment gave a significantly lower ADG and poorer F/G ($P<.05$). The AFB treatment was the only other treatment that showed a lower ADG. The F/G ratios were numerically lower for the remaining treatments than for the control. All diets were consumed at higher rates than the control.

Table 10. Effect of Insect- and Fungal-damaged Grain Sorghum on Pig Performance

	Control	LGB	RW	RFB	Mixture	AG	AC
Avg. daily gain (Kg) Day 1-14	.60^{a,b}	.61^{a}	.50^{d}	.55^{b,c}	.57^{a,b,c}	.53^{c,d}	.59^{a,b}
Feed to gain Day 1-14	1.89^{c}	1.95^{b,c}	2.23^{a}	1.93^{b,c}	2.02^{a,b,c}	2.19^{a,b}	1.91^{c}
Daily feed intake Day 1-14	1.13^{a}	1.19^{a}	1.12^{a}	1.06^{a}	1.15^{a}	1.16^{a}	1.13^{a}
Avg. daily gain (Kg) Day 14-28	.55^{a,b}	.58^{a}	.51^{b}	.56^{a,b}	.59^{a}	.60^{a}	.60^{a}
Feed to gain Day 14-28	2.51^{b}	2.52^{b}	2.91^{a}	2.58^{b}	2.48^{b}	2.47^{b}	2.48^{b}
Daily feed intake (Kg) Day 14-28	1.38^{a}	1.46^{a}	1.48^{a}	1.44^{a}	1.46^{a}	1.48^{a}	1.49^{a}
Avg. daily gain (Kg) Day 1-28	.57^{a}	.60^{a}	.50^{b}	.55^{a}	.58^{a}	.56^{a}	.60^{a}
Feed to gain Day 1-28	2.18^{c}	2.20^{c}	2.57^{a}	2.25^{b,c}	2.25^{b,c}	2.33^{b,c}	2.19^{c}
Daily feed intake (Kg)	1.24^{a}	1.32^{a}	1.26^{a}	1.24^{a}	1.31^{a}	1.30^{a}	1.31^{a}

^{a,b,c,d}Row means with the same superscripts are not significantly different.

Conclusions

This trial was designed to determine the effect of feeding insect-damaged and fungal-damaged grain sorghum to the young pig. The results indicate that, although there was a great deal of visual damage to the grain, the young pig performed adequately on all treatments except the rice weevil treatment. In most cases, feed consumption increased and feed efficiency decreased, neither response, however, was significant.