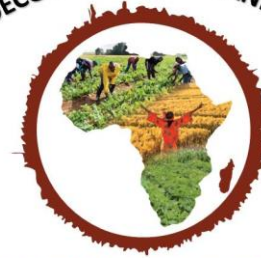


TRANSFORMING AGRICULTURE IN AFRICA
AGROECOLOGY and ORGANIC TRADE



Reducing Synthetic Pesticides and Fertilizers

Growth and Reproductive Parameters Impairment of Glyphosate (herbicide) in Male Guinea Pig (*Cavia porcellus*)

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INTRODUCTION

A large number of chemicals such as glyphosate have been used to increase or maintain agricultural productivity in DRC

Glyphosate



Used to weed out unwanted plants

Most herbicide used in USA, UK, Germany, Denmark, Argentina, Africa

Most controversial pesticide product

Controversial results



ROS, decrease sperm characteristics, loss in body weight, haematological and biochemical damage, neurotoxic, genotoxic (Mesnage et al., 2017, De Liz et al., 2013, Jasper et al., 2012)

No adverse reproductive and growth parameters (Dhinsa et al., 2007; Takahashi, 1997)



In South Kivu province, Eastern of DR Congo, most of livestock species are mostly fed with crop residues and food crops weeds (Mutwedu et al., 2015, Mugumaarhahama et al., 2016, Wasso et al., 2018, Akili et al., 2018, Metre et al., 2019)

- They could be impaired while feeding if forages were exposed to glyphosate.

Objective

To provide insight on the growth and reproductive toxicity of glyphosate

Materials and methods

Study site Experimental unit of the Department of Animal Production of the UEA in Bukavu, DRC

Chemical Glyphosate (N-(phosphonomethyl) glycine) in a commercial formulation 36 % (360 g/L)

Animals, Lodging, Feeding



- 40 local adult male guinea-pigs weighing 397.89 ± 38.84 , divided into 4 groups of 10 animals each one
- Wooden cages (1 x 1 x 0.5 m) at room temperature (20 to 26 °C), relative humidity of $74 \pm 6\%$
- Animals of group 1 received 10 ml/kg of distilled water, those of groups 2, 3 and 4 received respectively 186, 280 and 560 mg glyphosate/kg b.w

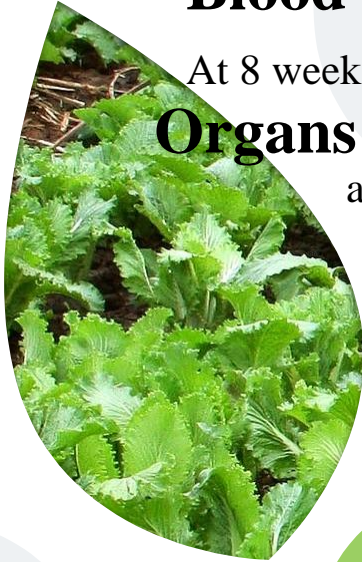


- LD50 was 5600 mg/kg b.w (Monsanto Company 1985; National Library of Medicine, 1992).
- Water and feed were provided *ad libitum*
- F.I, W.G. were measured weekly

Blood and organs collections

At 8 weeks of treatments, 6 guinea pigs from each treatment group were humanely sacrificed

Organs Kidney, lung, heart, liver, testes, epididymis, vas deferens collected, freed of adipose tissue, washed and blot-dried for weight and volume evaluation.



Blood

Hematological parameters analysis (Hb, WBCs, RBCs, LYM, MCV, MCH, MCHC, PCV) using automated hematology analyzer MINDARY BC 3000.

Biochemical analysis (serum content in total cholesterol, albumin, AST, ALT, urea, creatinine protein and glucose using Chronolab® commercial kits)

Semen characteristics

Epididymis of each animal was removed and minced in 10 ml of warm 0.9% NaCl solution (40°C), and spermatozoa obtained following technique described by Sharma et al. (2009).

Semen motility (Mohammed and Engidawork, 2011), viability (Amorim et al., 2009), sperm count determined using a haemocytometer, morphology using Eosin/Nigrosin test.

Results

Growth performances

Parameters	Dose of glyphosate (mg/kg bw)				Effect rate (%)
	0 (n = 6)	186 (n = 6)	280 (n = 6)	560 (n = 6)	
Initial body weight (g)	396.30 ± 48.98	393.80 ± 40.86	393.30 ± 34.72	418.40 ± 18.15	5.6
Final body weight (g)	461.80 ± 12.94a	430.60 ± 7.66b	424.40 ± 9.82bc	416.60 ± 5.12c	-9.8
Body weight gain (g)	65.50 ± 16.08a	36.80 ± 15.59ab	31.10 ± 18.81ab	-1.80 ± 21.19b	-102.2
Average weekly feed intake (g)	176±11.6ab	183± 10.9a	156±14.8b	153±14.2b	-13.1

Relative weights and volumes of some organs

Parameters	Dose of glyphosate (mg/kg bw)				Effect rate (%)
	0 (n = 6)	186 (n = 6)	280 (n = 6)	560 (n = 6)	
Weights organs					
Kidney	0.52±0.02c	0.57±0.02b	0.57±0.025b	0.67±0.034a	28.8
Liver	2.01±0.26b	2.01±0.25b	2.28±0.07ab	2.52±0.05a	25.4
Lung	0.13±0.03	0.13±0.03	0.12±0.04	0.15±0.02	2.0
Heart	0.05±0.03	0.04±0.01	0.05±0.01	0.05±0.02	0.0
Test	0.50±0.03a	0.49±0.03a	0.41±0.03b	0.38±0.03b	-24.0
Epididymis	0.10±0.01	0.12±0.01	0.12±0.03	0.13±0.03	3.0
Vas deferens	0.06±0.01	0.06±0.05	0.07±0.01	0.06±0.03	0.0
Volumes of organs (ml)					
Kidney	1.90±0.15	1.85±0.19	1.82a±0.18	1.85±0.18	-5.0
Liver	10.5±1.05b	11.16±1.16b	12.83±0.98ab	14.00±1.78a	33.3
Test	1.25±0.22a	1.21±0.21ab	1.17±0.13ab	0.93±0.17b	32.0

Sperm characteristics

Parameters	Dose of glyphosate (mg/kg bw)				Effect rate (%)
	0 (n = 6)	186 (n = 6)	280 (n = 6)	560 (n = 6)	
Mobility (%)	93.33±10.32a	50.0±16.73b	50.0±20.97b	30.0±10.95b	-67.9
Viability (%)	74.66±9.68a	66.71±4.82a	42.46±4.97b	35.33±4.03b	-52.7
Sperm concentration (10 ⁶ /mL)	276.0±68.14a	242.3±41.59a	197.3±48.04b	163.6±56.12b	-40.7
Semen morphology (%)					
Major anomalies	7.96±1.12b	7.5±1.19b	11.48±3.42a	10.20±1.05a	28.1
Minor anomalies	24.7±12.38ab	19.73±6.11b	35.58±7.38a	35.90±3.69ab	45.3

Haematological parameters

Parameters	Dose of glyphosate (mg/kg bw)				Effect rate (%)
	0 (n = 6)	186 (n = 6)	280 (n = 6)	560 (n = 6)	
Hb (g/dl)	14.80±0.33ab	14.03±0.29b	14.88±0.77ab	15.64±1.031a	5.7
PCV (%)	40.22±1.84	38.73±0.74	41.68±4.69	42.66±2.60	6.0
RBC (x10 ¹² /l)	5.40±0.22ab	5.29±0.14b	5.62±0.23ab	5.78±0.28a	7.0
MCV (fl)	71.23±2.76b	73.33±1.33ab	73.84±1.68ab	75.24±1.46a	5.6
MCH (pg)	27.38±0.59	26.48±0.47	26.43±0.89	27.00±0.87	-1.4
MCHC (g/dl)	36.42±2.43	36.15±1.30	37.15±2.68	36.30±2.53	-0.3
WBC (x10 ⁹ /l)	12.86±3.99ab	9.88±2.84b	14.86±2.76ab	17.84±5.46a	38.7
Lymphocytes (%)	4.10±1.32	4.15±1.38	5.72±2.49	6.75±5.53	64.10

Biochemical parameters

Parameters	Dose of glyphosate (mg/kg bw)				Effect rate (%)
	0 (n = 6)	186 (n = 6)	280 (n = 6)	560 (n = 6)	
Serum total cholesterol (mg/dl)	133.57±9.70b	149.62±15.30b	179.7±19.79ab	184.07±12.90a	37.8
Creatinine (mg/dl)	0.76±0.08b	0.73±0.08b	0.83±0.10ab	0.93±0.04a	22.4
Urea (mg/dl)	81.71±19.36b	166.28±32.12a	121.29±26.78ab	152.81±29.04ab	87.1
ALAT (IU)	17.88±1.96b	21.06±3.85b	28.86±1.48a	31.15±1.57a	74.2
ASAT (IU)	18.64±1.42c	22.56±1.98b	34.91±4.69a	35.18±2.82a	88.7
Glucose (mg/dl)	29.54±18.68	39.09±17.61	26.59±22.31	27.04±12.17	-8.4
Serum total protein (g/dl)	2.37±0.15a	2.36±0.16a	2.08±0.05b	2.09±0.05b	-11.8
Serum total albumin (g/dl)	3.34±0.17	3.32±0.38	3.22±0.22	3.14±0.21	5.9

Conclusion

Glyphosate had deleterious effects to male guinea pig after 8 weeks of treatment.

The growth performances, epididymal semen characteristics, weight of detoxifying organs and hematobiochemical parameters were seriously impaired.

Recommendations

The use of glyphosate must be reviewed and limited due to its hazardous effect.

If animals consume a suspected glyphosate-infected food, they may be treated with plant extracts and / or essential oils as their efficacy in alleviating pesticide toxicity have already been proven.

Thanks!

ANY QUESTIONS?

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