



Effects of cadmium pollution on the growth and yield responses of wild *vigna*

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Introduction

- There are a number of natural and anthropogenic processes which add Cd to the environment (Inuwa, 2004) and its phytotoxic effects (Gallego *et al.*, 2012).
- Wild *vigna* an underutilized plant is a good feed for deer, ground birds and has high water holding capacities.
- This study aimed to determine the effects of Cd pollution on the germination index and dry matter accumulation of wild *vigna*

Materials and Methods

- Seed Collection: wild *Vigna* seeds (TVNu-91, TVNu-93, TVNu-94, TVNu-95 and TVNu-96)
- Experiment: Top soil was obtained from a fallow site and contaminated with Cd (as CdCl₂) on the basis of Phytotoxicity benchmark (or ESV) of Cd (4mg/kg) as 2.5ESV and 5ESV. The control soil was not contaminated.
- plant germination factors, plant yield, percentage chlorosis, necrosis and senesced leaves, and plant dry matter accumulation were considered as presented in the results and discussion section

Results and discussion

Table 1: Effects of Treatment on germination parameter of Wild vigna at 7 days after sowing

Plant Accessions		First day of emergent (days)	Final Emergent percentage (%)	Mean daily emergent (%/day)	Mean emergent time
Cd. Conc. (ESV)					
TVNu-91	0	3.00	66.67	9.53	5.33
	2.5	4.20	66.67	9.53	6.00
	5	4.60	33.33	4.76	6.00
TVNu-93	0	3.70	66.67	9.53	5.33
	2.5	3.90	66.67	9.53	6.00
	5	4.00	66.67	9.53	6.00
TVNu-94	0	3.30	33.33	4.76	5.33
	2.5	3.60	66.67	9.53	5.33
	5	3.90	33.33	4.76	5.33
TVNu-95	0	2.30	66.67	9.53	5.00
	2.5	2.80	33.33	4.76	5.00
	5	2.87	66.67	9.53	5.00
TVNu-96	0	2.34	33.33	4.76	4.67
	2.5	2.56	33.33	4.76	4.67
	5	2.77	33.33	4.76	5.00
P-value		0.147	0.000	0.012	0.034
Sig*		P>0.05	P=0.000	P<0.01	P<0.05

Table 2: Effects of Treatment on emergent speed of Test Wild vigna at 7 days after sowing

Plant Accessions		Daily emergent speed (DES) (%hr ⁻¹)	Emergent rate index (ERI) (%d ⁻¹)	Emergent index (EI)	Coefficient of velocity of emergent
Cd. Conc. (ESV)					
TVNu-91	0	2.40	0.58	17.86	2.00
	2.5	2.40	0.17	4.76	1.33
	5	5.04	0.17	4.76	1.33
TVNu-93	0	2.40	0.58	17.86	2.33
	2.5	2.40	0.17	4.76	1.33
	5	2.40	0.17	4.76	1.00
TVNu-94	0	5.04	0.42	17.86	1.33
	2.5	2.40	0.42	17.86	1.33
	5	5.04	0.42	17.86	1.33
TVNu-95	0	2.40	0.83	26.19	2.00
	2.5	5.04	0.83	26.19	2.00
	5	2.40	0.83	26.19	1.67
TVNu-96	0	5.04	1.17	21.43	1.00
	2.5	5.04	1.17	21.43	0.67
	5	5.04	1.17	13.09	0.33
P-value		0.147	0.000	0.012	0.034
Sig*		P>0.05	P=0.000	P<0.01	P<0.01

Table 3: Effects of Treatment on seedling vigour of Wild vigna 28 days after sowing

Plant Accessions	Cd. Conc. (ESV)	Seedling vigour index I	Seedling vigour index II
TVNu-91	0	22.42	0.06
	2.5	18.87	0.02
	5	7.35	0.01
TVNu-93	0	27.05	0.06
	2.5	17.98	0.02
	5	22.57	0.02
TVNu-94	0	9.41	0.03
	2.5	15.06	0.02
	5	7.38	0.01
TVNu-95	0	53.14	0.10
	2.5	18.35	0.03
	5	40.29	0.06
TVNu-96	0	9.52	0.03
	2.5	8.53	0.02
	5	8.57	0.02
P-value		0.020	0.223
Sig*		P<0.01	P>0.05

Table 4: Percentage of total foliar chlorosis of wild vigna at 84 days after sowing

Plant Accessions	Cd. Conc. (ESV)	No. of affected leaves per Plant partition			Total
		Younger	Intermediate	Older	
TVNu-91	0	0	0	4.30	4.30
	2.5	0	4.22	16.90	21.12
	5	4.08	4.08	20.40	28.56
TVNu-93	0	0	2.05	2.05	4.10
	2.5	4.43	4.43	13.29	22.14s
	5	5.39	5.39	21.57	32.36
TVNu-94	0	0	2.24	4.48	6.72
	2.5	0	7.96	11.94	19.90
	5	4.53	9.07	18.13	31.73
TVNu-95	0	1.65	1.65	3.30	6.60
	2.5	5.43	2.72	13.58	21.72
	5	6.55	6.55	19.65	32.74
TVNu-96	0	0	1.73	3.46	5.19
	2.5	2.58	5.17	10.33	18.08
	5	6.55	6.55	16.37	29.47
P-value		0.614	0.553	0.984	0.999
Sig*		P>0.05	P>0.05	P>0.05	P>0.05

Table 5: Percentage of total foliar necrosis of wild vigna at 84 days after sowing

Plant Accessions	Cd. Conc. (ESV)	No. of affected leaves per Plant partition			Total
		Younger	Intermediate	Older	
TVNu-91	0	2.15	2.15	6.44	10.74
	2.5	4.22	12.67	16.90	33.80
	5	4.08	16.32	20.40	40.80
TVNu-93	0	0	4.10	4.10	8.21
	2.5	8.86	8.86	17.71	35.43
	5	10.79	16.18	21.57	48.54
TVNu-94	0	2.24	2.24	4.48	8.96
	2.5	7.96	7.96	19.90	35.81
	5	9.07	13.60	27.20	49.86
TVNu-95	0	1.65	3.30	4.95	9.89
	2.5	2.72	8.15	16.29	27.15
	5	3.27	9.82	22.92	36.02
TVNu-96	0	1.73	1.73	6.93	10.39
	2.5	5.17	5.17	15.50	25.83
	5	6.55	6.55	22.92	36.02
P-value		0.520	0.685	0.995	0.969

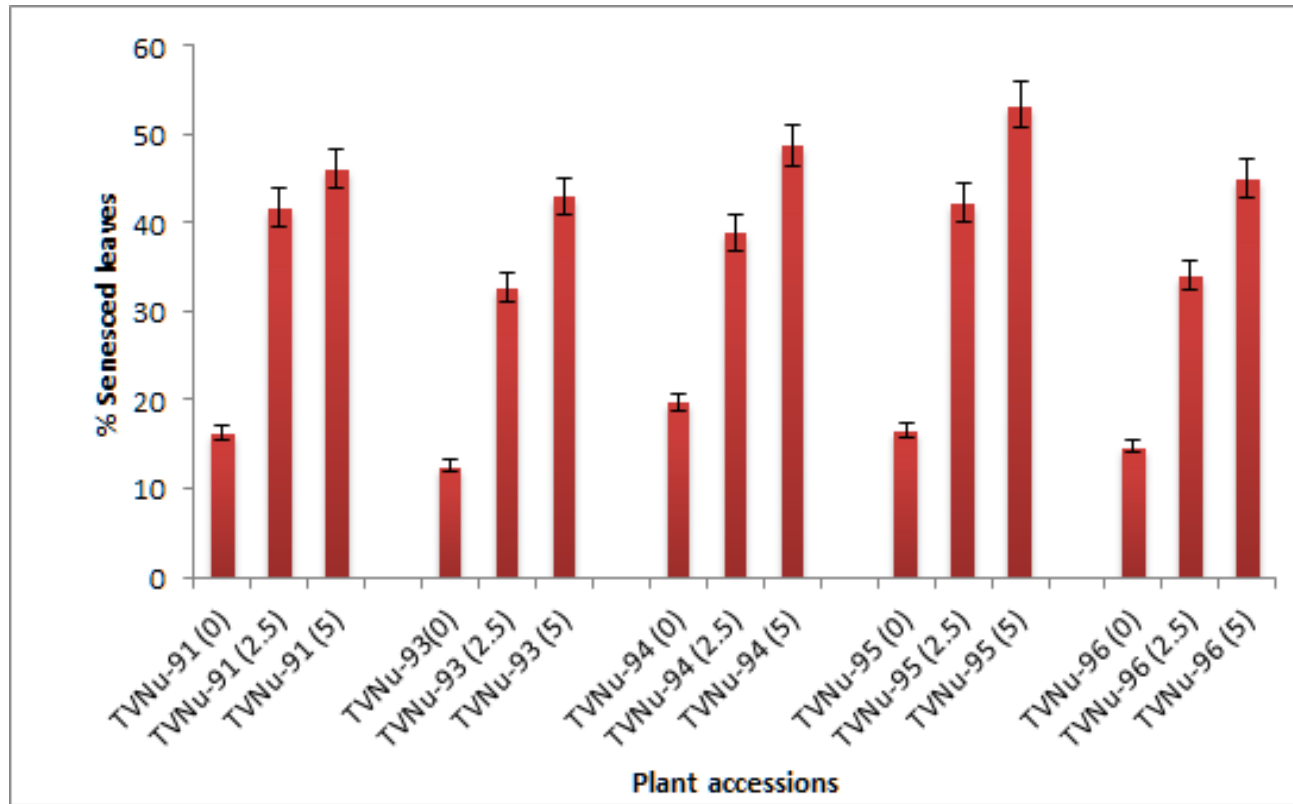


Fig 1: Percentage senesced leaves of wild vigna accessions 84 days after sowing

Table 6: Effects of cadmium pollution on Plant Dry Matter Accumulation of Wild vigna at 20 weeks after sowing

Plant Accessions	Cd Conc.	Overall foliar yield (g)	Plant dry weight(g)	Root dry weight (g)	Shoot: Root Ratio
TVNu-91	0	44.20	19.45	1.45	12.41
	2.5	34.11	12.62	1.02	11.37
	5	29.15	7.44	0.97	6.67
TVNu-93	0	114.17	37.34	13.82	1.70
	2.5	85.38	29.09	11.77	1.47
	5	59.34	23.79	10.49	1.27
TVNu-94	0	52.07	17.89	0.87	19.56
	2.5	33.93	12.87	0.78	15.50
	5	28.79	8.50	0.58	13.66
TVNu-95	0	28.66	3.67	0.49	6.49
	2.5	17.01	1.92	0.16	11.00
	5	13.45	1.54	0.15	9.27
TVNu-96	0	86.93	37.50	3.88	8.66
	2.5	45.84	19.07	3.74	4.10
	5	42.75	17.17	3.52	3.88
P-value		0.010	0.004	0.000	0.000
Sig*		P<0.01	P<0.01	P=0.000	P=0.000
LSD		21.70	13.20	12.25	16.02

Conclusion

There was a gradual decrease in growth and yield properties with increasing metal concentration. However, TVNu-95 had an overall foliar yield as compared to the other studied accessions making it the preferred in a Cd-polluted soil.

Reference

- **Gallego, S.M.**, Pena, L.B., Barcia, R.A., Azpilicueta, C.E., Iannone, M.F., Rosales, E.P. (2012). Unravelling cadmium toxicity and tolerance in plants: in sight in to regulatory mechanisms. *Environmental Experimental Botany*, **83**: 33–46.
- **Inuwa, M.** (2004). Analytical Assessment of Some Trace Metal in Soils of Sodan Apple (Calotropis procera) Around the Major Industrial Areas of North West Zone. Unpublished M.Sc. Dissertation.

