Plant Archives Vol. 25, Supplement 1, 2025 pp. 1172-1177 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.supplement-1.158

EFFICACY OF COW URINE ENRICHED BOTANICALS AGAINST POD BORER, *HELICOVERPA ARMIGERA* HUBNER INFESTING CHICKPEA *CICER ARIETINUM* L.

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(Date of Receiving : 13-08-2024; Date of Acceptance : 22-10-2024)

ABSTRACT

Investigation on "cow urine enriched botanicals against pod borer, *H. armigera*" was carried out at Agronomy Instructional Farm, S.D. Agricultural University, Sardarkrushinagar during *rabi*, 2023. Results revealed that all the treatments were significantly superior over control. Three applications of jatropha leaf extract (10%) + cow urine (10%) was significantly effective among all treatments with minimum mean larval population and pod damage (%). The highest grain yield was found in jatropha leaf extract (10%) + cow urine (10%)(1548kg/ha) treatment followed by ipomoea leaf extract (10%)+ cow urine (10%)(1480 kg/ha) and ipomoea leaf extract (10%) + cow urine (10%) (1416kg/ha).Significantly lowest grain yield was recorded in control (790 kg/ha).
Keywords: Cow urine, botanicals, *H. armigera*, chickpea, jatropha leaf extract.

Introduction

Pulse crops occupy a unique position in the world of agriculture by virtue of their high protein content. Chickpea [*Cicer arietinum* (L.)] is a self-pollinated crop belonging to the sub-family Papillionaceae of family Leguminoseae. It is one of the important crops with high adaptability and wider use. Besides being rich in protein, its ability to fix atmospheric nitrogen through biological nitrogen fixation is economically sound and environmentally acceptable. The crop has multiple uses like grain, vegetable purpose and fodder for the milch animals. In India, major chickpea producing states are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka, Andhra Pradesh, Chhattisgarh, Jharkhand, Gujarat, Telangana, Bihar, Haryana and West Bengal. The total area, production and productivity of our country is 104.71 lakh ha, 122.67 lakh tones and 1172 kg/ha, respectively (Anon., 2023b). Insect pest cause greater damage in terms of attack on the economical part of the plant (pod) and hence decreases the yield of the crop drastically. Among the important pests, pod borer has been a significant problem with a variety of crops for its polyphagous nature. The attack of pod borer is reported on nearly 182 economically important crop plant species ranging from food to fibre, horticulture and oilseeds crops (Gowda *et al*., 2007). Farmers generally sprayed insecticides at full pod or pod maturing stage when full-grown pod borer is visible on the plant with bored pods. As a result, the grown-up pod borers are not killed moreover it creates environmental pollution, left residual toxicants, kill natural enemy, cause insect resurgence etc. Over-dependence of chemicals is one of the important reasons for quick development of resistance. Their indiscriminate use has generated number of well-known problems. However, in the year of epidemic, use of conventional insecticides fails to regulate the damage. Use of chemical pesticides has resulted in immediate high returns to farmers. However, their heavy and extensive use has created

various health and environmental problems. Among the several avenues to overcome the insecticidal resistance problem, use of botanicals (plant products) is one of the important considerations for controlling pod borers on chickpea. Botanicals degrade rapidly from sunlight, air, and proper moisture, which generally makes them less toxic to the environment, but may also require them to be applied more often, applied correctly, and with more precise timing. Botanical plant products are less expensive, readily available, environmentally safe and less hazardous in comparison to chemical insecticides (Saxena *et al*., 2001). The failure of modern methods forced the scientific community to go back to traditional and natural resources to handle the problem of pest outbreak. The plant product, neem seed kernel extract @5% + cow urine + cow dung extract @ 5% treatment exhibiting more toxic effect on eggs and larvae of *H. armigera* with low larval growth index (Boomathi *et al.* 2006). Similarly, efficacy of panchagavya and clerodendron extract + cow urine (10 %) in decreased the larval population amongst other cow urine-based formulations (Byrappa *et al*., 2012). Further, maximum mortality (26.32%) of third instar *H. armigera* treated with cow urine + cow dung @ 5% (Danish *et al.,* 2016). Keeping the above points in view, the present investigation on cow urine enriched botanicals were evaluated against pod borer in chickpea.

Materials and Methods

A field experiment was laid-out during *rabi* 2023 in Randomized Block Design (RBD) at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar with ten treatments including an untreated control and were replicated thrice. First spray was applied at the time of appearance of pest on chickpea and second spray was applied 10 days after the first spray. Third spray was applied 10 days after the second spray. A chickpea variety GJG6 was sown with a spacing of 45 cm × 10 cm, between rows and plants, respectively. For each treatment, a gross plot size of 4.5m ×5.0 m with Net plot size of 3.6m x4.0m was maintained. Nine botanical insecticides *viz.,* Cow urine (10%), Custard apple leaf extract (10%), Jatropha leaf extract (10%), Ipomoea leaf extract (10%), Noni leaf extract (10%), Custard apple leaf extract (10%) + cow urine (10%), Jatropha leaf extract (10%) + cow urine (10%), Ipomoea leaf extract (10%) + cow urine (10%), and Noni leaf extract (10%) + cow urine (10%) was tested in comparison with untreated control against chickpea pod borer. The observations on the number of larvae per ten plant and pod damage caused by *H. armigera* was made a day before and after 5 and 9 days after treatment imposition.

Results and Discussion

Effect of different treatments on larval population

The data on larval population of pod borer was recorded after 5 and 9 days of spray, pooled over periods and pooled over period over sprays are presented in Table 1. Larval population was found homogenous in all the evaluated treatments before spray as treatment differences were non-significant. The data indicated that mean number of *H. armigera* larvae ranged from1.14 to 8.56 larvae per10 plants. Significantly least larval population (1.14 larvae/ 10plants) was observed in jatropha leaf extract (10%) + cow urine (10%) which is effective botanical against *H.armigera* larvae. The treatments ipomoea leaf extract (10%) + cow urine (10%) (1.66 larvae/10 plants), noni leaf extract (10%) + cow urine (10%) (1.66 larvae/10 plants) and custard apple leaf extract (10%) + cow urine (10%) (1.69 larvae/10 plants), respectively are found at par with each other. The treatments jatropha leaf extract (10%) (2.03 larvae/10 plants), ipomoea leaf extract (10%) (2.09 larvae/10 plants), noni leaf extract (10%) (2.16larvae/10plants), custard apple leaf extract (10%) (2.29larvae/10plants) are found next effective botanicals however, among the botanicals evaluated against pod borer, cow urine (10%) (4.43larvae/10plants) are recorded higher larval population and least effective against larva of *H.armigera* in chickpea. However, scanty information available with respect to effectiveness of cow urine extracted botanicals. Therefore, studies conducted on other botanical extracts and cow urine are compared to the present findings. According to Ladji *et al.* (2011) pongamia leaf extract (10%) + NSKE (10%) + aloe (0.5%) + cow urine (30%) combination, GCA (2%) +GCK (0.5%) combination and vitex leaf extract (20%) + clerodendron extract (4%) + cow urine (17%) combination found effective by recording maximum reduction in larval population (56.11, 46.85 and 46.85%) of *H. armigera* larvae. Further, Kumar and Yadav (2023) noted that plant extracts of *Calotropis gigantean* 5% @50ml /lit (3.31 larval population /5plant) and *Ageratum conyzoides* 5% @50ml/lit (3.49 larval population/ 5 plant) recorded lesser larval population and found effective against on chickpea pod borer.

Effect of different treatments on pod damage

The data on capsule damage recorded after 5 and 9 days ofspray, pooledoverperiods and pooled over period over sprays are presented in Table 2. Pod damage was found homogenous in all the evaluated treatments before spray as treatment differences were

non- significant. Mean number of pod infestation ranged from 12.53 to 36.20 percent. Significantly lower pod infestation (12.53%) was recorded in jatropha leaf extract 10 % + cow urine 10%. The treatments, custard apple leaf extract 10% + cow urine 10% (18.39%), noni leaf extract 10% +cow urine 10% (18.98%), ipomoea leaf extract 10% (19.22%), ipomoea leaf extract (10%)+ cow urine 10% (19.33%), noni leaf extract 10% (19.81%), jatropha leaf extract 10% (20.99%), custard apple leaf extract 10% (23.30%) were at par with each other. The treatment cow urine 10% (28.16%) noticed higher pod infestation. Significantly maximum pod infestation was recorded in control (36.20%). Information available with respect to effectiveness of cow urine extracted botanicals against *H.armigera* in chick pea is scanty. Therefore, studies conducted on other botanical extracts along with cow urine are compared. The results by Ladji *et al.* (2011) who revealed that pongamia leaf extract (10%) + NSKE (10%) + aloe (0.5%) + cow urine (30%) combination, GCA (2%) + GCK (0.5%) combination and vitex leaf extract (20%) + clerodendron extract (4%) + cow urine (17%) combination found effective and recorded higherpod yield (9.42, 8.62 and 8.45 q/ha)in chickpeawhile, Rahman *et al*. (2014) reported that the lowest fruit infestation of tomato (number and weight basis) was observed in neem seed kernel extract (27.15%, 22.29%) and tobacco leaf extract (27.71%, 23.31%).

Yield and avoidable loss

The data on yield, increase in yield over control and avoidable losses were obtained in various insecticide treatments are presented in Table 3. Perusal of the results showed that all the treatments proved significantly superior over control with respect to grain yield of chickpea (790 kg/ha). Significantly higher grain yield (1548 kg/ha) was recorded in jatropha leaf extract (10%) + cow urine (10%). The treatments ipomoea leaf extract (10%) + cow urine (10%) (1480 kg/ha), noni leaf extract (10%) + cow urine (10%) (1416 kg/ha) and custard apple leaf extract (10%) + cow urine (10%) (1388 kg/ha), respectively which are at par with each other. The treatments jatropha leaf extract (10%) (1180 kg/ha), ipomoea leaf extract (10%) (1123 kg/ha), noni leaf extract (10%) (1025 kg/ha), custard apple leaf extract (10%) (993 kg/ha) and cow urine (10%) (880 kg/ha) are next best treatments and recorded lower grain yield of chickpea.As per the report of Ladji *et al.* (2011) pongamia leaf extract (10%) + NSKE (10%) + aloe (0.5%) + cow urine (30%) combination, GCA (2%) + GCK (0.5%) combination and vitex leaf extract (20%) + clerodendron extract (4%) + cow urine(17%) combination recorded higher pod yield (9.42, 8.62 and 8.45 q/ha) in chickpea which is found similar to our study.

Increase in yield over control

The maximum increase in yield over control was (95.94%) recorded in the treatment jatropha leaf extract (10%) + cow urine (10%) followed by ipomoea leaf extract (10%) + cow urine (10%) (87.34 %), noni leaf extract (10%) + cow urine (10%) (79.24%) and custard apple leaf extract (10%) + cow urine (10%) (75.69 %) increase in yield over control. The other botanicals i.e. jatropha leaf extract (10%), ipomoea leaf extract (10%), noni leaf extract (10%) and custard apple leaf extract (10%) recorded 49.36, 42.15, 29.74 and 25.69 per cent increase in yield over control. The minimum increase in yield over control (11.39%) was recorded in cow urine (10%).

Avoidable losses

Avoidable losses in yield of chickpea are revealed that losses varied from 4.39 to 43.15 per cent in different treatments (Table 4.17). The avoidable losses were the minimum (4.39 %) in ipomoea leaf extract (10%) + cow urine (10%) in comparison to jatropha leaf extract (10%) + cow urine (10%) treatment. Noni leaf extract (10%) + cow urine (10%) and custard apple leaf extract (10%) + cow urine (10%) recorded 8.52 and 10.33 per cent avoidable losses in chickpea. The other treatments jatropha leaf extract (10%), ipomoea leaf extract (10%), noni leaf extract (10%), custard apple leaf extract (10%) and cow urine (10%) recorded with 23.77, 27.45, 33.78, 35.85 and 43.15 per cent avoidable losses, respectively. Maximum avoidable loss of 48.96 per cent was recorded from control treatment.

Conclusion

Application of Jatropha leaf extract (10%) + cow urine (10%) was found superior and effective among all treatments and recordedlesser mean larval population (1.14 larvae/10 plants) pod damage (12.53 %) and significantly higher grain yield (1548 kg/ha)

Table 1: Efficacy of different treatments on larval population of *H. armigera* on organically grown chickpea

Tr. N.	Treatments	Number of *H. armigera* larvae/ten plants										
			Firstspray			Secondspray			Thirdspray			Pooled over period over sprays
		Before Spray	5 DAS	9 DAS	Pooled over period	5 DAS	9 DAS	Pooled over period	5 DAS	9 DAS	Pooled over period	
1.	Cow urine(10%)	1.57^{a} (1.98)	1.56^{b} (1.93)	1.86^{b} (2.94)	1.70^{b} (2.39)	1.69^{b} (2.34)	2.67^{b} (6.63)	2.17^{b} (4.21)	2.80^{b} (7.31)	2.79^{b} (7.27)	2.79^{b} (7.28)	2.22^{b} (4.43)
2.	Custard apple leaf extract(10%)	1.55^{a} (1.91)	1.28^{c} (1.13)	1.57^{cd} (1.95)	1.42^{cd} (1.52)	1.42^{cd} (1.52)	1.98^{c} (3.41)	1.70^{c} (2.39)	1.90^{c} (3.09)	1.88^{c} (3.03)	1.88^{c} (3.03)	1.67^{c} (2.29)
3.	Jatropha leaf extract(10%)	1.55^{a} (1.91)	1.40^{bc} (1.46)	1.68^{c} (2.31)	1.53^{bd} (1.84)	1.52^{bc} (1.81)	1.59^{de} (2.01)	1.55^{cde} (1.90)	1.76^{cd} (2.59)	1.62^{cd} (2.14)	1.69^{c} (2.36)	1.59^{c} (2.03)
4.	Ipomoea leaf extract(10%)	1.56^{a} (1.94)	1.24^{c} (1.05)	1.38^{de} (1.39)	1.31^{cd} (1.22)	1.37^{cd} (1.38)	2.06^{c} (3.73)	1.71^{c} (2.42)	1.83^{c} (2.86)	1.81^{cd} (2.78)	1.82^{c} (2.81)	1.61^{c} (2.09)
5.	Noni leaf extract (10%)	1.55^{a} (1.91)	1.24^{c} (1.04)	1.64^{c} (2.19)	1.44^{cd} (1.57)	1.43^{cd} (1.54)	1.80^{cd} (2.75)	1.61^{cd} (2.09)	1.87^{c} (3.00)	1.80^{cd} (2.73)	1.83^{c} (2.85)	1.63^{c} (2.16)
6.	Custard apple leaf extract(10%)+cow urine (10%)	1.56^{a} (1.94)	1.28^{c} (1.14)	1.39^{de} (1.42)	1.33^{cd} (1.27)	1.37^{cd} (1.38)	1.44^{de} (1.59)	1.40^{def} (1.46)	1.71^{cd} (2.41)	1.74^{cd} (2.51)	1.72^{c} (2.46)	1.48^{cd} (1.69)
7.	Jatropha leaf extract(10%)+cow urine (10%)	1.5^{a}(1.87)	1.22^{c} (0.99)	1.27^{e} (1.11)	1.24^{d} (1.04)	1.24^{d} (1.04)	1.31^{e} (1.23)	1.27^{f} (1.11)	1.33^{d} (1.27)	1.34^{d} (1.31)	1.33^{d} (1.27)	1.28^{d} (1.14)
8.	Ipomoea leaf extract(10%)+cow urine (10%)	1.55^{a} (1.91)	1.33^{c} (1.27)	1.31^{de} (1.22)	1.32^{cd} (1.24)	1.35^{cd} (1.32)	1.38^{de} (1.40)	1.36^{ef} (1.35)	1.61^{cd} (2.09)	1.84^{cd} (2.89)	1.72^{c} (2.46)	1.47^{cd} (1.66)
9.	Noni leaf extract (10%)+ cow urine(10%)	1.57^{a} (1.98)	1.25^{c} (1.06)	1.30^{e} (1.19)	1.27^{d} (1.11)	1.29^{cd} (1.16)	1.46^{de} (1.63)	1.37^{def} (1.38)	1.78^{cd} (2.42)	1.75^{cd} (2.56)	1.76^{c} (2.60)	1.47^{cd} (1.66)
10.	Control	1.62^{a} (2.14)	1.76^{a} (2.59)	2.17^{a} (4.20)	1.96^{a} (3.34)	2.38^{a} (5.18)	3.60^{a} (12.48)	2.99^{a} (8.44)	3.99^{a} (15.45)	4.19^{a} (17.03)	4.09^{a} (16.23)	3.01^{a} (8.56)
S.Em±	Treatment(T)	0.05	0.06	0.07	0.077	0.07	0.08	0.212	0.09	0.09	0.063	0.033
	Period(P)	-	-	-	0.022	-	-	0.025	-	-	0.029	0.015
	Spray(S)	-	-	-	-	-	-	-	-	-	-	0.018
	T×P	-	-	-	0.068	-	-	0.078	-	-	0.091	0.047
	T×S	-	-	-	-	-	-	-	-	-	-	0.057
	P×S	-	-	-	-	-	-	-	-	-	-	0.026
	T×P×S	-	-	-	-	-	-	-	-	-	-	0.081
C.D.at5%		NS	0.19	0.21	0.25	0.21	0.25	0.68	0.28	0.26	0.18	0.093
C.V.(%)		5.40	8.29	7.97	8.13	8.03	7.62	7.83	7.82	7.35	7.59	8.04

*Figures outside parenthesis are arcsine transformed values, while those in parenthesis are retransformed values. Treatment means with the letter(s)in common are not significant by DNMRT at 5 per cent level of significance. DAS: Day(s) after spray. NS: Non-significant

Table 2: Efficacy of different treatments on pod infestation of *H. armigera* on organically chickpea

Tr. No	Treatments	Pod infestation (%)										
			Firstspray			Secondspray			Thirdspray			Pooled over Period over sprays
		Before Spray	5 DAS	9 DAS	Pooled over period	5 DAS	9 DAS	Pooled over period	5 DAS	9 DAS	Pooled over period	
1.	Cow urine(10%)	20.70^{a} (12.50)	22.75^{b} (14.96)	28.61^{ab} (22.93)	26.04^{ab} (19.27)	30.75^{b} (26.15)	34.30^{b} (31.75)	32.82^{b} (29.38)	36.57^{b} (35.50)	37.46^{b} (36.99)	37.29^{b} (36.71)	32.05^{b} (28.16)
2.	Custard apple leaf extract(10%)	18.93^{a} (10.53)	19.57^{b} (11.22)	26.39^{bc} (19.75)	23.73^{bc} (16.19)	26.42^{c} (19.80)	32.42^{bc} (28.75)	29.75^{bc} (24.62)	32.75^{bc} (29.27)	33.60^{c} (30.62)	33.47^{bc} (30.42)	28.86^{bc} (23.30)
3.	Jatropha leaf extract (10%)	18.81^{a} (10.40)	20.44^{b} (12.19)	25.28^{bcd} (18.24)	23.25^{bc} (15.58)	26.60^{c} (20.05)	30.64^{bcd} (25.98)	28.95^{bc} (23.43)	29.07^{cd} (23.61)	29.53^{d} (24.29)	29.62^{cd} (24.43)	27.27^{c} (20.99)
4.	Ipomoea leaf extract(10%)	18.75^{a} (10.33)	20.83^{b} (12.64)	23.37^{cde} (15.74)	22.50^{bc} (14.64)	25.68^{c} (18.78)	28.75^{cd} (23.13)	27.56^{c} (21.41)	28.44^{cd} (22.67)	26.79^{d} (20.31)	27.95^{d} (21.97)	26.00^{c} (19.22)
5.	Noni leaf extract(10%)	18.98^{a} (10.57)	20.26^{b} (11.99)	23.67^{cde} (16.12)	22.36^{bc} (14.47)	26.45^{c} (19.83)	28.70^{cd} (23.07)	27.91^{c} (21.91)	29.29^{cd} (23.94)	28.08^{d} (22.16)	29.01^{cd} (23.52)	26.43^{c} (19.81)
6.	Custard apple leaf extract(10%)+cow urine(10%)	18.72^{a} (10.30)	20.37^{b} (12.11)	24.10^{cde} (16.67)	22.63^{bc} (14.81)	23.37^{cd} (15.73)	26.80^{d} (20.33)	25.45^{c} (18.47)	27.32^{d} (21.06)	28.19^{d} (22.32)	28.09^{d} (22.17)	25.39^{c} (18.39)

7.	Jatropha leaf extract(10%)+ cow urine(10%)	18.63^{a} (10.20)	19.48^{b} (11.12)	19.98^{e} (11.68)	20.17^{c} (11.89)	20.13^{d} (11.84)	20.34^{e} (12.08)	20.66^{d} (12.45)	20.69^{e} (12.48)	21.24^{e} (13.12)	21.37^{e} (13.28)	20.73^{d} (12.53)
8.	Ipomoea leaf extract(10%)+cow urine(10%)	18.68^{a} (10.26)	19.74^{b} (11.41)	22.06^{de} (14.11)	21.32^{c} (13.22)	24.68^{cd} (17.43)	29.58^{cd} (24.37)	27.47^{c} (21.28)	30.13^{cd} (25.20)	28.15^{d} (22.26)	29.46^{cd} (24.19)	26.08^{c} (19.33)
9.	Noni leaf extract(10%) +cow urine(10%)	18.67^{a} (10.25)	19.65^{b} (11.31)	24.55^{cd} (17.26)	22.50^{bc} (14.64)	24.83^{c} (17.63)	26.37^{d} (19.73)	25.95^{c} (19.15)	27.93^{d} (21.94)	29.48^{d} (24.22)	29.03^{cd} (23.55)	25.83^{c} (18.98)
10.	Control	20.78^{a} (12.58)	26.01a (19.23)	31.05^{a} (26.60)	28.85^{a} (23.28)	35.34^{a} (33.46)	40.47^{a} (42.12)	38.18^{a} (38.21)	43.04^{a} (46.59)	44.31^{a} (48.79)	43.94^{a} (48.15)	36.99^{a} (36.20)
S.Em±	Treatment(T)	0.68	1.04	1.22	0.828	1.26	1.50	0.958	1.45	1.38	0.937	0.532
	Period(P)	-	-	-	0.358	-	-	0.438	-	-	0.447	0.238
	Spray(S)	-	-	-	-	-	-	-	-	-	-	0.292
	T×P	-	-	-	1.133	-	-	1.386	-	-	1.413	0.753
	T×S	-	-	-	-	-	-	-	-	-	-	0.922
	P×S	-	-	-	-	-	-	-	-	-	-	0.412
	T×P×S	-	-	-	-	-	-	-	-	-	-	1.304
C.D.at5%		NS	3.09	3.63	2.36	3.74	4.46	2.73	4.30	4.09	2.67	1.491
C.V.(%)		6.19	8.44	8.37	8.42	8.15	8.62	8.43	8.12	7.70	7.91	8.19

*Figures outside parenthesis are arcsine transformed values, while those in parenthesis are retransformed values. Treatment means with the letter(s)in common are not significant by DNMRT at 5 per cent level of significance. DAS: Day(s) after spray. NS: Non-significant

Table 3: Impact of treatments on yield and avoidable losses in chickpea

Tr. N.	Treatments	Yield (kg/ha)	Increase yield over control (%)	Avoidable loss (%)
1.	Cow urine(10%)	880^{cd}	11.39	43.15
2.	Custard apple leaf extract(10%)	993^{cd}	25.69	35.85
3.	Jatropha leaf extract (10%)	1180^{bc}	49.36	23.77
4.	Ipomoea leaf extract(10%)	1123^{bc}	42.15	27.45
5.	Noni leaf extract(10%)	1025^{cd}	29.74	33.78
6.	Custard apple leaf extract(10%)+cow urine(10%)	1388^{ab}	75.69	10.33
7.	Jatropha leaf extract(10%)+ cow urine(10%)	1548^{a}	95.94	-
8.	Ipomoea leaf extract(10%)+cow urine(10%)	1480^{a}	87.34	4.39
9.	Noni leaf extract(10%) +cow urine(10%)	1416^{ab}	79.24	8.52
10.	Control	790^{d}	-	48.96
S.Em.±		93.45	-	-
C.D.at5%		277.64	-	-
C.V.(%)		13.69	-	-

Treatments means with the letter(s) in common are not significant by DNMRT at5 per cent level of significance.

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