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Effect of liming on available N and Fe content of acid soil

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Nitrogen and iron are required by plants for the growth and metabolic activities. Liming acidic soils has been reported to increase the production of mineral N content with the simultaneous decrease in soil organic matter. Application of N fertilizer may influence the process of Fe transformation in soil. On the other hand, Fe fertilization may also affect the transformation process of different inorganic forms of N in soil. Although considerable amount of research works have been carried out in past to study the influence of Fe on availability of N or vice-versa (Das, 2003), but very little investigation has been carried out to monitor the simultaneous changes of different forms of available N and Fe due to application of N and Fe fertilizers either alone or in combination.

The soil sample (0-15cm depth) used for the present investigation was composite sample of cultivated field under Bidhan Chandra Krishi Viswavidyalaya farm at Jhargram in the district of West Midnapur, West Bengal. Limed soil was prepared as per Sarkar and Saha (2007). The relevant physical and chemical properties of (Table 1) both the soils were analyzed. Each 25 g of the unlimed and limed soils were taken separately in 100ml beakers for the present study. Soils were maintained at 60% moisture holding capacity (MHC). Then the soils were allowed for incubation in the laboratory at room temperature (30 ± 2°C) for a period of 90 days. Five separate sets were maintained for laboratory analysis on 0^{th}, 15^{th}, 45^{th}, 60^{th} and 90^{th} day of incubation. The treatments included in the incubation study for both the unlimed and limed soils were represented as follows:

T_1 = Soil, T_2 = Soil + N at mg Kg^{-1}, T_3 = Soil + Fe at 10 mg Kg^{-1}, T_4 = Soil + N at 75 mg Kg^{-1} + Fe at 10 mg Kg^{-1}

All the treatments were replicated thrice. Exchangeable NH_4^+ and soluble NO_3^- were estimated according to the method of Bremner and Keeney (1966). Iron (exchangeable Fe^{2+} and Fe^{3+}) were estimated by the method of Jackson, 1973.Sources of N was $(NH4)_2SO_4$ and Fe was $FeSO_4$.

Table 1. Physical and chemical characteristics of limed and unlimed soil

Sl. No.	Characteristics	Soil		Methods adopted
		Unlimed	Limed	
1	pH (soil : water : : 1:2.5)	5.30	6.85	Glass electrode pH meter (Black, 1965)
2	EC(dsm^{-1})	0.18	0.26	Electrical conductivity bridge, (Black, 1965)
3	Moisture holding capacity (%)	42.04	43.68	Keen-Rackzoswski method (Piper, 1950)
4	Cation exchange capacity [cmol (p^+) kg^{-1}]	10.90	11.50	Schollenberger and Simon (Jackson, 1967)
5	Clay (%)	22.20	22.20	Hydrometer method
6	Textural classes	Sandy clay loam	Sandy clay loam	
7	Oxidisable organic carbon (%)	0.22	0.20	Walkley and Black method (Jackson, 1967)
8	Total N (mg kg^{-1})	1199.54	1141.52	Stevenson,1996
9	Exchangeable NH_4^+	70.67	72.21	Bremner and Keeney, 1966
10	Soluble NO_3^-	63.66	62.77	Bremner and Keeney, 1966
11	Exchangeable ferrous iron (Fe^{2+})	39.34	38.73	Jackson, 1973
12	Ferric (Fe^{3+}) iron	41.84	41.28	Jackson, 1973
13	Nomenclature according to USDA System of soil classification	Plinth Ustalfs	Plinth Ustalfs	USDA

Irrespective of treatments both available nitrogen and iron tended to decrease with increase in the period of investigation (Table 2). The decrease in available nitrogen with time was due to conversion of certain amount of NH_4^+ to NO_3^- - N or lost from the soil system either through denitrification (Groffman *et al.*, 1988) or volatilization (Freney and Black, 1988) as well as due to immobilization of this fraction to organic forms (Broadbent and Nakashima, 1970). Further more comparatively lesser amount of available nitrogen is decreased over 90 days period of incubation in limed than that of unlimed soil. This trend of results was found due to the production of exchangeable NH_4^+ through mineralization of organic N under congenial limed situation (Ghosh *et al.*, 1990). Liming of acid soil creates a favorable environment for activities of microorganisms (Das, 2004) which in turn consume certain amount of exchangeable Fe^{2+} and Fe^{3+} forms of iron in soil throughout the period of investigation. Close investigation of the data revealed that in general, the amount of available N increased in limed over the unlimed soil treated with or without iron. This is perhaps due to the disappearance of the ill effect of iron on ammonifying bacteria. Further, it is also noted that intensity of decrease over 90 days period is more in limed over the unlimed soil. The present line is in accordance with Das, 2004.

Table 2. Changes in the amount (mg Kg^{-1}) of available nitrogen (NH_4^++NO_3^-) and iron (exchangeable Fe^{2+} + Fe^{3+}) in limed and unlimed soil affected by the application of N and Fe fertilizers.

Treatments	Unlime/ Lime	Incubation period (Days)									
		0		15		45		60		90	
		N	Fe	N	Fe	N	Fe	N	Fe	N	Fe
Soil	Unlimed	134.33	81.18	120.96	74.34	118.02	68.36	93.82	62.17	76.42	56.55
	Limed	134.98	80.03	117.92	72.37	114.40	66.65	98.43	57.92	77.40	49.54
Soil+N	Unlimed	200.08	79.59	168.40	78.69	150.74	73.39	129.79	64.20	119.47	59.35
	Limed	199.94	81.04	165.94	75.33	148.88	70.96	132.20	59.09	120.06	49.66
Soil+Fe	Unlimed	131.84	97.43	120.31	93.99	107.79	89.62	98.92	84.19	87.48	74.33
	Limed	132.04	95.26	118.31	90.82	110.91	83.62	103.66	75.75	93.04	65.24
Soil+N+Fe	Unlimed	194.68	101.64	160.66	99.61	120.72	90.09	108.64	83.56	69.20	78.06
	Limed	192.86	97.13	155.47	93.49	122.72	81.08	109.85	76.13	101.81	61.98

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Studies on weed management practices in guava cv. L-49

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Weeds are the most important competitor with the associated crop sharing nutrients, light, moisture, space etc which adversely affect the main crop in respect of growth, yield and quality attributes. It interferes with orchard operations and increase labour cost also. With the increase of labour wages and non availability of labour, chemical methods of weed management are comparatively less expensive and gaining popularity in the area of guava orchards as economic and easy management practices. Maurya and Shankar, (1982) observed that the plant height of young guava seedling was checked by 50% due to weeds like *Cynodon dactylon*. Martinez and Pereira (1984) suggested that pre- emergence use of Diuron (1.6 kg/ha), Oryzalin (1.67 lit./ha), Simazine (1.6 kg/ha) or Atrazin (1.6 kg/ha) can control the weeds in guava orchards and they also found that fruit yield and quality of guava cv.L-49 were improved by application of Atrazin (5 kg/ ha) or Oxyfluorfen (0.05 kg/ha). In West Bengal, Kundu *et al.,* (1997) reported that yield, fruit quality and leaf nutrient status of guava was improved by chemical control of weeds. Very little information is available regarding weed control in guava orchard in West Bengal, but the area under guava cultivation in West Bengal is increasing day by day. In West Bengal, guava ranks 6th in production, 5th in acerage and 4th in productivity among the fruit crops. In 2006-07, the total fruit production in West Bengal was 2301.7 thousand tonnes from 172.69 thousand hectare area of which guava contributes 6.6 per cent in total fruit production from 5.7 per cent area with 15.5 tonnes per hectare productivity. Therefore, an attempt has been made to evaluate effective weed management practices to control weeds in guava orchard grown in new alluvial zone of West Bengal.

The experiment was conducted at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during the period 2006-2007 in winter months on 13 years old guava orchard. Guava plants were planted at 6m x 6m spacing, two plants enclosed in each block of 12m x 6m size, treated as one replication. The chemical treatments were Glyphosate @ 0.5 kg a.i./ha, Glyphosate @ 1.0 kg a.i./ha, 2,4-D Na salt @ 1.0 kg a.i. /ha, 2,4-D Na salt @ 1.2 kg a.i. /ha, and a combination of Glyphosate @ 0.5 kg a.i./ha and 2,4-D Na salt @ 1.0 kg a.i. /ha at 25 days after glyphosate application.A spray volume of 600 litre per hectare was used to apply the herbicides. Glyphosate was applied as pre-emergence at first week of September, 2006 and 2, 4-D Na salt was applied 30 days after glyphosate application. Hand weeding was done at monthly interval. The weeds (categorized in grass, sedges and broad leaf weeds) were counted and dry weight of weeds per m^2 were recorded at 30 days, 60 days , 90 days and 120 days after first herbicidal treatment. The experiment was laid out in randomized block design with three replications in each treatment. The weed control efficiency (WCE) was determined by using the formula-

$$WCE(\%) = \frac{X - Y}{X} \times 100$$

Where,

X = Dry matter weight of weeds in unweeded plot.

Y = Dry matter weight of weeds in treated plot.

Short Communication

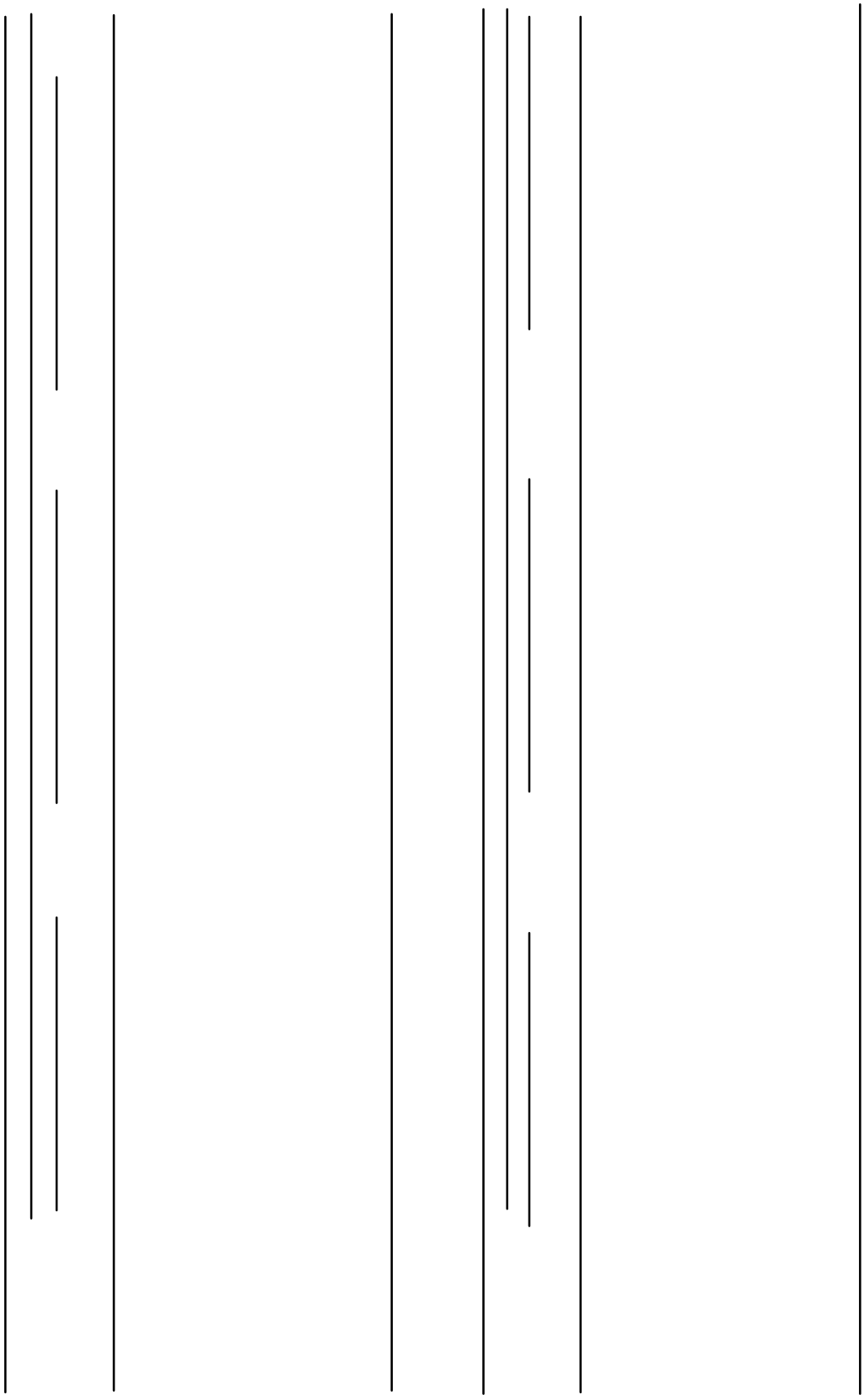
Cynodon dactylon, Cyperus rotudus, Commelina benghalensis, Dicanthium annulatum, Vernonia cinerria, Chicorium intybus were found as major weeds in the experimental plot. The quality characteristics of fruits like total soluble solids, total sugar, reducing sugar, titratable acidity, vitamin C were analyzed using the standard A.O.A.C. (1970) procedure.

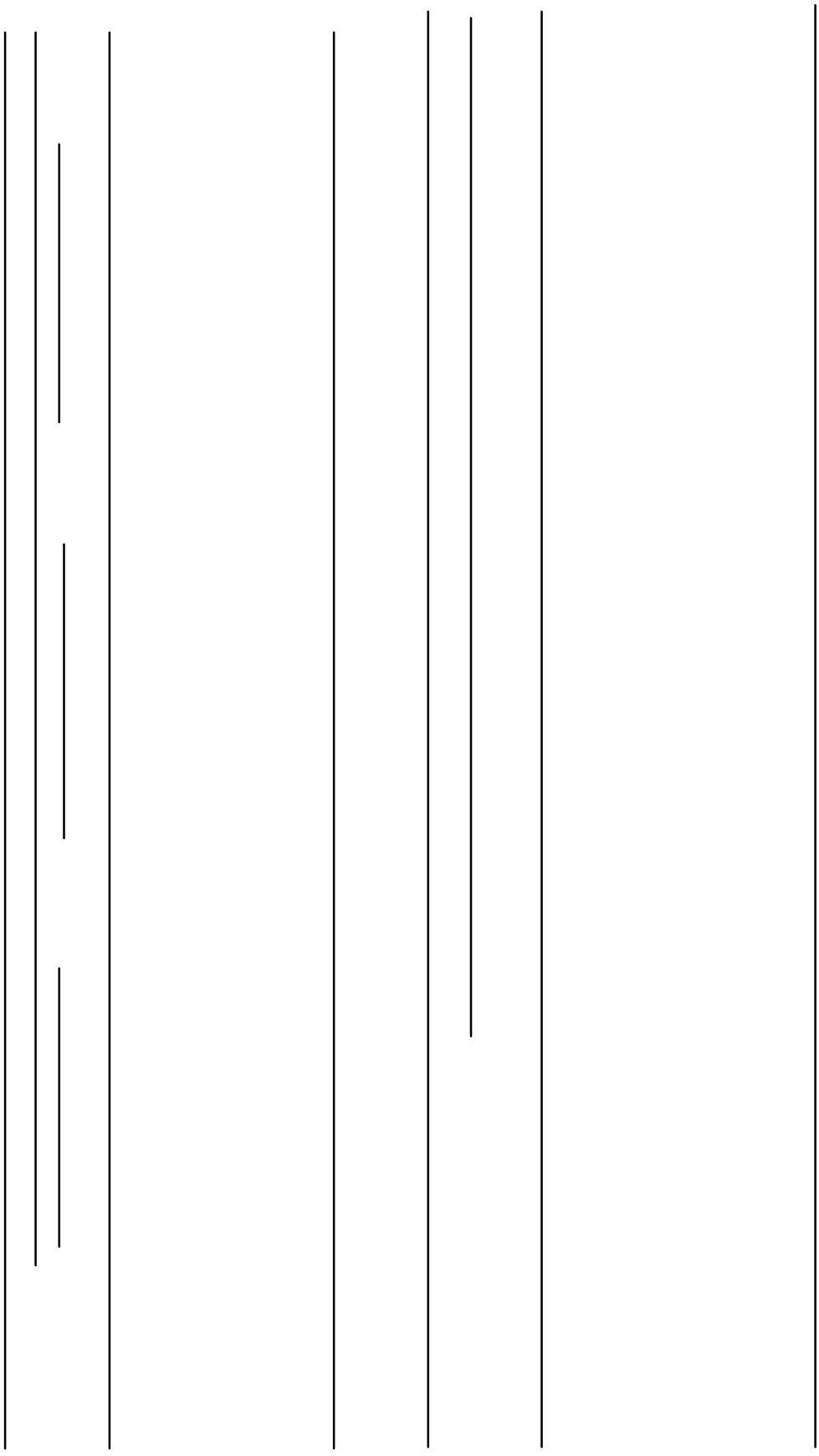
The periodical records of weed density per m^2 as presented in Table 1 showed that all the chemical treatments along with manual weeding checked the weed population in all stages of weed growth and in all categories of weeds over control. In all the cases weed population was increased with the increasing days from starting of the experiment. The most effective weed control method was observed in case of manual weeding at monthly intervals (T_6) in checking weed growth throughout the winter months. Similar trend was also found by Kundu *et al*., (1997). The combination of Glyphosate @ 0.5 kg a.i. /ha and 2, 4-D Na salt @ 1 kg a.i. /ha) recorded the better weed control efficiency which was found statistically at par with manual weeding throughout the period of investigation. Similar trend of weed control was also found in dry weight basis as stated in Table -2. It was also found that the chemical herbicides were less effective at 90 days after treatment, as the weed population suddenly increased at higher rate at 90 days after treatment (Table 3) and it might be due to the reason that the chemical herbicides might loose their effectiveness after 90 days against those weed flora. On the other hand, weed population was increased at slow rate throughout the period of investigation in manual weeding. Among the chemical herbicides the combination of Glyphosate @ 0.5 kg a.i. /ha and 2, 4-D @ 1kg a. i. /ha (T_5) was proved to be the most effective practice close to the manual weeding. Management of weeds also increased the yield potentiality of guava due to less competition.

All the quality attributes of fruits (TSS, total sugar, acidity and vitamin C) except reducing sugar were significantly improved by all the treatments. The highest TSS (12.20^{o}B) was found in manual weeding (T_6) followed by T_5 (11.97^{0}B) and lowest was recorded in unweeded control (10.73 ^{o}B). Fruits with maximum total sugar (10.40%) were observed in T_5, whereas manual weeding produced fruits with 10.33 % total sugar. Although improvement in reducing sugar was non-significant, the maximum reducing sugar (4.67%) was found in T_5 (Glyphosate @ 0.5 kg a.i./ha and 2,4-D Na salt @ 1.0 kg a.i. /ha) and all the treatments showed an increase in reducing sugar over control (Table 4).

The lowest acidity (0.29 %) was found in fruits in the plots under hand weeding at 30 days interval (T_6). The highest vitamin C content (158.67 mg / 100 g fruit pulp) in fruit was also found in manual weeding followed by combination of Glyphosate @ 0.5 kg a.i./ha and 2,4-D Na salt @ 1.0 kg a.i. /ha (T_5) and overall improvement in all the treatments over control (Table 4).

From the above findings, it may be concluded that weed control treatments effectively reduced the weed population and thereby increased the availability of water, nutrients to the plant and plants suffer a least competition. Considering the treatments effect on weed population, dry weight, weed control efficiency and fruit quality of fruits, the manual weeding at monthly intervals was the most effective treatment followed by treatment combination of Glyphosate @ 0.5 kg a.i. /ha and 2, 4-D @ 1kg a. i. /ha during winter months for guava grown in new alluvial zone of West Bengal.





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