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Soil Available Nutrient Status, Nutrient Uptake, Bulb Yield and Shelf Life of Onion as Influenced by Use of Organic Manures and *Panchakavya*

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ABSTRACT: *A field trial was conducted to study the effect of five different sources of nitrogen viz. farm yard manure, poultry manure, green leaf manure, sheep manure with and without Panchakavya to supply recommended dose of nitrogen on equal nitrogen basis on soil available nutrient status, nutrient uptake, bulb yield and shelf life of onion at S.V. Agricultural College, Tirupati. Uptake of nitrogen, phosphorus and potassium were the highest with recommended dose of NPK (T_2), poultry manure and FYM respectively followed by green leaf manure and other organic sources tried. Highest bulb yield was recorded with application of recommended dose of NPK through fertilizers (T_2). Next best treatments were green leaf manure either with or without Panchakavya (T_9 and T_8) with significant disparity over FYM or sheep manure or poultry manure either with or without Panchakavya (T_5, T_4, T_{11}, T_7, T_6, and T_{10}) which were comparable with each other. As regards the post harvest soil available N, P_2O_5 and K_2O, the highest positive balance of soil available N and K_2O were found associated with green leaf manure, while that of phosphorus was associated with poultry manure. However, all the organic manures could result in higher balance than with application of fertilizer. Weight loss (%) of bulbs during storage was lesser with poultry manure either with or without panchakavya ($T_7$and T_6) followed by green leaf manure or sheep manure or FYM either with or without panchakavya (T_9, T_8, T_{11}, T_{10}, T_5 and T_4).*

Key words: Bulb yield, onion, organic manures, Panchakavya, soil available nutrient status.

Organic farming is very much native to our country, dates back to more than 4,000 years, which had maintained the soil fertility status over enormously long period of time. In contrast, chemical farming is hardly 50 years old and caused soil degradation, depletion of water resources, increased incidence of pests and diseases, appearance of new weed biotypes etc. Organic agriculture is a holistic food production management system, which promotes and ensures biodiversity, biological cycles and soil biological activity by giving preference to the use of on-farm inputs, which are highly adapted to the production system. Onion *(Allium cepa* L.*)*, is one of the most important condiments and vegetable crops grown almost in all parts of India and used throughout the year for its wide and varied uses in the kitchen. Because of its higher nutritional and great medicinal value, onion is considered very useful for human beings. Although many attempts have been made to study the effect of fertilizers on onion crop, systematic research work on different organic manures is needed for onion cultivation, particularly in A.P because research work on this aspect is lacking. *Panchakavya*, an organic source for promotion of growth and yield enhancement in crops, is a combination of five products obtained from cow. The products from cow have the ability to bring the flow of cosmic energy which in turn can revitalize the growth process. As a salvation, our Indian knowledge system is a treasure trove of information and *Panchakavya* has been one such piece of traditional wisdom meant to safe guard plants and soil microorganisms. Considering the

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above facts, the present research work was undertaken to assess the role of *Panchakavya*, FYM, green leaf manure, poultry manure and sheep manure on onion

MATERIALS AND METHODS

The experiment was laid out in Randomized Block Design with three replications at the Dry land Farm of Sri Venkateswara Agricultural College, Tirupati during *rabi,* 2007. There were eleven treatments *viz*., Control (T_1), Recommended dose of NPK through fertilizers (T_2), Periodical spraying of *Panchakavya* alone (T_3), FYM without *Panchakavya* (T_4), FYM with *Panchakavya* (T_5), Poultry manure without *Panchakavya* (T_6), Poultry manure with *Panchakavya* (T_7), Green leaf manure without *Panchakavya* (T_8), Green leaf manure with *Panchakavya* (T_9), Sheep manure without *Panchakavya* (T_{10}) and Sheep manure with *Panchakavya* (T_{11}). All the manures and fertilizers were supplied as per the treatments. The recommended dose of fertilizers were applied in T_2 treatment (80-50-40 kg N, P_2O_5 and K_2O ha^{-1}). Entire quantity of P_2O_5 and K_2O and half of the nitrogen was applied basally at the time of planting. Remaining half of the nitrogen was applied as top dressing 30 DAT through band placement 5 cm away from the crop row. The sources of N, P_2O_5 and K_2O were urea, single super phosphate and muriate of potash respectively. Four organic manures on equal nitrogen basis (80 kg N ha^{-1}) were applied in respective treatments. All the organic manures were added to the soil and thoroughly incorporated 10 days prior to sowing of the crop. The details of organics used are detailed below. Nutrient content, quantities of different organic manures required to supply nutrients on equal nitrogen basis and the quantities of P and K added correspondingly due to application of different organics are furnished in Table 1.

The following ingredients were used to prepare approximately 5 litres of *Panchakavya* stock solution. Cow dung (1 kg), Cow's urine (750 ml), Cow's milk (500 ml), Cow's curd (500 ml) and Cow's ghee (250 ml). In addition, sugarcane juice (750 ml), tender coconut water (750 ml), pure honey (250 ml) and ripe bananas (250 g) were also added to accelerate the fermentation process. All the materials were added to a wide mouthed earthen pot and kept open under shade. The contents were stirred twice a day for about 20 minutes, both in the morning and evening to facilitate aerobic microbial activity. After fifteen days, the contents were filtered to get the clear stock solution of *Panchakavya*. The stock solution was diluted to three percent spray solution and it was applied as foliar spray @ 500 l ha^{-1} to onion at fortnightly intervals starting from 15 DAT to 15 days before harvest. The spray solution was sprayed with high pore size nozzle, to facilitate adequate interception by the crop foliage.

Table 1: Nutrient content of different organic sources

Organic sources	*Nutrient content (%)*			*Quantity on fresh weight basis (t ha^{-1}) to supply recommended dose of nitrogen (80 Kg N ha^{-1})*	*Quantity of P (kg ha^{-1}) added through different organic sources*	*Quantity of K (kg ha^{-1}) added through different organic sources*
	N	*P*	*K*			
Farm yard manure	0.68	0.20	0.50	11.76	23.52	58.82
Poultry manure	2.54	2.00	1.40	3.15	62.98	44.08
Neem leaf	0.50	0.28	0.35	16.00	44.8	56.0
Sheep manure	3.00	1.00	2.00	2.66	26.66	53.32

Recommended agronomic practices were adopted to grow a good and healthy crop. Oven dried plant samples of onion at harvest were finely powdered and used for chemical analysis. Nitrogen, phosphorus and potassium content was analysed by the standard procedures outlined by Jackson [2]. The uptake of N, P and K at harvest was calculated by multiplying the nutrient content with corresponding dry matter production and expressed as kg ha^{-1}. Immediately after harvest of the crop, soil samples were drawn from each treatment and analyzed for available nitrogen [Subbiah and Asija 7], available phosphorus (Olsen *et al.,* [3]) and available potassium (Jackson, [2]). The data obtained on various parameters *viz*., nutrient uptake and post harvest soil fertility status of onion during the study were statistically analyzed by following the analysis of variance for Randomized Block Design as suggested by Panse and Sukhatme [4]. Statistical significance was tested by 'F' test at five per cent level of probability. Critical difference for the significant source of variation was calculated at five per cent level of significance. Treatmental differences those were not significant were denoted by NS.

RESULTS AND DISCUSSION

Effect on Nutrient Uptake

The magnitude of nutrient uptake was more in case of bulbs than shoots as reported by Shamima Nasreen and Hossain [5]. Nutrient uptake by shoots, bulbs and total nutrient uptake followed similar trend. The highest nitrogen uptake of onion was registered with recommended dose of NPK, since it was applied in suitable number of splits, to match the physiological needs of the crop, resulting in greater absorption compared to the organic source of N applied totally as basal. The highest phosphorus uptake was recorded with poultry manure and that of potassium was found with farm yard manure. This was due to higher levels of P and K in the corresponding organic manures, which happened to be due to application of manures on equal nitrogen basis (Table. 2).

Table 2
Nutrient uptake (kg ha^{-1}) by onion crop as influenced by use of organic manures and *Panchakavya*

Treatments	*Nitrogen*			*Phosphorus*			*Potassium*		
	Shoots	*Bulbs*	*(Shoots + bulbs)*	*Shoots*	*Bulbs*	*(Shoots + bulbs)*	*Shoots*	*Bulbs*	*(Shoots) bulbs)*
T_1: Control	12.70	16.82	29.52	5.26	7.77	13.03	18.59	26.42	45.01
T_2: Recommended dose of NPK through fertilizers	33.55	44.44	77.99	12.83	18.99	31.82	53.60	76.07	129.67
T_3: Periodical spraying of *Panchakavya* alone	13.33	17.67	31.00	5.82	8.61	14.44	20.90	29.70	50.61
T_4: FYM without *Panchakavya*	30.81	40.83	71.65	13.55	20.05	33.60	55.93	79.40	135.33
T_5: FYM with *Panchakavya*	31.25	41.41	72.66	13.90	20.58	34.48	56.76	80.57	137.33
T_6: Poultry manure without *Panchakavya*	30.41	40.32	70.73	17.59	26.02	43.61	51.59	73.30	124.88
T_7: Poultry manure with *Panchakavya*	30.85	40.88	71.74	17.97	26.57	44.54	53.03	75.30	128.33
T_8: Green leaf manure without *Panchakavya*	32.19	42.67	74.86	16.13	23.86	39.99	55.88	79.29	135.17
T_9: Green leaf manure with *Panchakavya*	32.29	42.81	75.11	17.15	25.37	42.51	56.18	79.70	135.88
T_{10}: Sheep manure without *Panchakavya*	30.39	40.30	70.69	15.54	23.00	38.54	55.18	78.35	133.53
T_{11}: Sheep manure with *Panchakavya*	30.76	40.78	71.54	16.04	23.72	39.54	55.67	79.05	134.6
CD (P=0.05)	0.92	1.26	2.09	0.68	1.01	0.57	1.71	1.56	2.25

Bulb Yield

The highest bulb yield of onion at harvest was recorded with recommended dose of NPK through fertilizers (T_2) (25.58 t ha^{-1}), which was significantly superior to all the other treatments. The next best treatment was green leaf manure with *Panchakavya* (T_9) (19.55 t ha^{-1}), which was however, comparable with green leaf manure without *Panchakavya* (T_8) (19.11 t ha^{-1}) and significantly higher than with rest of the treatments. Application of farm yard manure or poultry manure or sheep manure either with or without *Panchakavya* (T_4, T_5, T_6, T_7, T_{10} and T_{11}) were on par with each other. The lowest bulb yield at harvest was associated with control (T_1) (9.02 t ha^{-1}) which was on par with periodical spraying of *Panchakavya* alone (T_3) (9.99 t ha^{-1}). It is obvious that with recommended dose of NPK especially through fertilizers which can supply instantly available form of nutrients, any crop would perform at its best, because of adequate and balanced nutrient supply to the crop at the right time of requirement. Accordingly, the onion crop under comfortable nutrition could produce the growth parameters of highest stature, which would have resulted in accrual of large quantity of biomass and partitioning major fraction of assimilates to the sink, thus resulting in better yield structure which could result in the highest bulb yield. The lower bulb yield with organic sources was directly related to the lower stature of yield attributes due to lesser availability of N in soil solution because of slow mineralization process of organic sources (Table. 3). Similar findings were reported earlier by Bose *et al.* [1]. Growth parameters and yield were at their lowest with absolute control. It is obvious that modern genotypes of crops would under perform in the absence of adequate nutrient supply, since they are responsive only to the applied nutrients and the same thing happened in the present study.

Table 3
Post harvest soil fertility status and bulb yield of onion as influenced by organic manures and *Panchakavya* to onion

Treatments	*Available Nitrogen (kg ha^{-1})*	*Available Phosphorus (kg ha^{-1})*	*Available Potassium (kg ha^{-1})*	*Bulb yield (t ha^{-1})*
T_1 : Control	159.36	8.90	140.14	9.02
T_2 : Recommended dose of NPK through fertilizers	238.96	17.65	255.64	25.58
T_3 : Periodical spraying of *Panchakavya* alone	157.42	8.91	140.85	9.99
T_4 : FYM without *Panchakavya*	262.77	14.80	279.58	15.90
T_5 : FYM with *Panchakavya*	262.67	14.08	278.68	16.16
T_6 : Poultry manure without *Panchakavya*	241.87	18.97	265.88	15.32
T_7 : Poultry manure with *Panchakavya*	240.37	18.66	263.17	15.60
T_8 :Green leaf manure without *Panchakavya*	275.93	16.72	295.64	19.11
T_9 : Green leaf manure with *Panchakavya*	274.71	16.34	294.32	19.55
T_{10} : Sheep manure without *Panchakavya*	245.20	15.73	267.54	15.02
T_{11} : Sheep manure with *Panchakavya*	242.30	15.22	266.34	15.85
CD (P=0.05)	3.28	1.64	7.15	1.19

Post Harvest Soil Fertility Status

Among the organic sources tried, green leaf manure, farm yard manure replenished more available nitrogen to soil than with that of sheep manure and poultry manure. (Table. 3). Further, the mineralization of organic manures and release pattern of nitrogen into the soil solution differs a large and accordingly, the final balance of soil available nitrogen would reflect source-wise. The build up of soil available phosphorus status with varied manurial practices was in the descending order of poultry manure, fertilizer, green leaf manure, sheep manure and farm yard manure. While the build up of soil available potassium status with varied manurial practices was in the descending order of green leaf manure, farm yard manure, sheep manure, poultry manure and fertilizer. The P and K content of different organic sources tried differed to a large extent and the final balances of P and K were in commensurate to their respective contents of P and K in different organic sources.

All the three major nutrients were found depleted after harvest of onion crop with the control and periodical spraying of *Panchakavya* alone, which might be due to non-supply of NPK through any source coupled with exhaustion of native soil nitrogen, phosphorus and potassium by the crop. Among the organic manures, the residual left over with respect to the major nutrients was commensurate with respective nutrient content of different organic manures and depletion pattern of nutrients due to differential uptake by different crops. It was clearly found from this study that foliar application of *Panchakavya* alone to onion could not exert any pronounced effect either on the nutrient uptake or post harvest soil fertility status and this was just comparable with control.

Shelf Life (Percent Weight Loss during storage)

The consumption of onion is spread through out the year and there is steady demand for onion bulbs all

Table 4
Weight loss (%) of onion bulbs during storage as influenced by organic manures and *panchakavya*

Treatments	*Days after Storage*				
	10	*30*	*50*	*70*	*90*
T_1 : Control	5.08	7.31	8.96	10.62	12.60
T_2 : Recommended dose of NPK through fertilizers	5.18	7.84	10.06	12.37	15.09
T_3 :Periodical spraying of *panchakavya* alone	5.02	7.26	8.83	10.59	12.40
T_4 : FYM without *panchakavya*	4.66	6.46	7.80	9.42	11.09
T_5 : FYM with *panchakavya*	4.61	6.40	7.67	9.17	11.21
T_6 : Poultry manure without *panchakavya*	4.16	5.83	6.94	8.33	9.91
T_7 : Poultry manure with *panchakavya*	4.21	5.81	6.92	8.30	9.88
T_8 :Green leaf manure without *panchakavya*	4.30	5.94	7.19	8.45	10.28
T_9 : Green leaf manure with *panchakavya*	4.24	5.88	7.10	8.36	10.14
T_{10} : Sheep manure without *panchakavya*	4.45	6.19	7.50	8.37	10.34
T_{11} : Sheep manure with *panchakavya*	4.50	6.36	7.58	8.70	10.65
CD (P=0.05)	0.45	0.66	0.90	1.15	1.31

the year round. Therefore the produce has to be stored for about 2-3 months to meet the demands of internal and export market. Shelf life (weight loss %) of onion up to 90 days was found superior with poultry manure either with or without *panchakavya* followed by green leaf manure, sheep manure and farm yard manure, which were comparable with each other (Table.4). The trend was in the descending order of phosphorus levels in the corresponding treatments, which happened to be due to application of manures on equal nitrogen basis. The results were in accordance with the findings of Singh *et al.* [13] that, the higher phosphorus fertilizer levels minimized the weight loss (Table 4).

The present investigation revealed that if organic farming is desired, one can go for the choice of organic sources to onion, depending on the abundant availability locally and cheaper cost among the sources, which could result in expected performance of a given crop.

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