STUDY ON SOIL FERTILITY VARIATIONS, DISTRIBUTION OF SOIL HEALTH REPORT AND KEY SUGGESTIONS FOR PROBLEMS IDENTIFIED FOR IMPROVEMENT OF LIVELIHOODS IN ADOPTED VILLAGE NARSIMHULAPALLE, TELENGANA, INDIA

Abstract

The Agricultural College, Sircilla of Professor Jayashankar Telangana State Agricultural University, as the sixth and youngest college of the University, started during the academic year 2018-19. One of the mandatory activities of the college in addition to academics is adoption of village and disseminating need based relevant technologies of the University for improvement of livelihoods of the villagers. Hence, a village by name Narsimhulapalle of Thangallapalli Mandal, Rajanna Sircilla district was adopted as part of extension activities of the college which is about 19 km from the college. Prior to the dissemination of improved technologies, the identification of existing scenario in the village with regards to soils, fertility status, crops, varieties, package of production technologies followed were taken up. Soil samples were collected with geo-positions from every farmer's field i.e., 114 farm holds of the village, processed and tested for fertility status. Action plan was prepared based on crop grown to alleviate the livelihoods of the village. A systematic collection of demographic, socio economic conditions and livelihoods of the villagers from primary and secondary sources along with prevailing farming practices were documented. All the 114 soils of the village were deficient in N, while majority of soils were medium to high with respect to available P and K. The Soil fertility based fertilizer recommendations were advocated to every individual farmer based on their soil test report for the crop grown. Soil fertility maps were prepared and displayed in the village Panchayat. Bridging of the identified

extension and research gaps was planned by proposing relevant technological interventions for the enhancement of livelihoods.

(Key words: Village adoption, soil fertility analysis, maps, recommendations)

Introduction

Village adoption is an activity to uplift the livelihoods of village incumbents through an advisory system which helps them through social, economic, informative platforms. This is a mandatory perspective of all agricultural colleges of the University, PJTSAU aimed at uplifting the rural livelihoods through introduction of agri-innovations and technologies. These include awareness creation from grass root level viz., soil fertility status, crop diversity, crop production techniques, seed production techniques livestock management, feed and fodder techniques, women empowerment through self help groups, and other small scale industries of the village like beedi making. The ideology of adoption of a village was also emphasized as a mission by Unnat Bharat Abhiyan. This mission enables higher educational institutions to work with the people of rural India in identifying development challenges and evolving appropriate solutions for accelerating sustainable growth. It also aims to create a virtuous cycle between society and an inclusive academic system by providing knowledge and practices for emerging professions and to upgrade the capabilities of both the public and the private sectors in responding to the development needs of rural India (www.unnatbharatabhiyan.gov.in).

Narasimhulapalle is a village in Tangallapally Mandal of Rajanna Sircilla District of Telangana State (Fig.1). The district of Rajanna Sircilla was a newly formed district carved out of erstwhile district of Karimnagar on 11th, October, 2016 through The Telangana Districts formation Act 1974. The village Narasimhulapalle is a small village with a

geographical and agricultural area of 434 and 287 ha, respectively. The total population was 546 with men: women ratio nearly 1:1. Agriculture was livelihood for 85% of village population. All the information about the village was collected through authentic sources such as; Gram Panchayat, mandal revenue department and ground truth was collected through participatory mode with help of agricultural field officer and college students through a questionaire. Data obtained was cross checked with the secondary data of gram panchayat, school, anganwadi and milk collection center of the village during 2019-2020. However, this research paper narrows down to soil sampling in farmer's field with geo-positions, cropping scenario, fertility evaluation and corresponding fertilizer recommendations for crops, based on soil test values.

Materials and Methods

Initially the village Narasimhulapalle was surveyed for crops grown and the soil types during early summer 2019. A field demonstration was conducted in farmer's field on soil sample collection. The fields varied in their moisture status based on the harvest timing of previous crop, hence a few fields needed a regular spade for sample collection while others required a crowbar to chisel the hard soil for collecting soil sample. One soil sample was collected from each farmer's field with identical field conditions; however with little variation in soil appearance and crop condition as observed by farmer himself, a separate sample was collected, all with geo-referencing. A total of 114 samples were collected from village farm fields covering each and every farmer with data collected through a 14 point questionnaire (Table 1) in vernacular language with below details.

Often more than two samples were collected from same farmer's field owing to variations in soil conditions and crop performance based on farmer's observation. The samples collected

were air dried in shade and pounded in wooden pestle and mortar and passed through 2mm sieve for further analysis.

The samples were analyzed for soil reaction, electrical conductivity (Jackson, 1973) and soil available nitrogen, phosphorus and potassium by methods recommended by Subbaiah and Asija, 1956; Olsen *et al.*, 1954 and Muhr *et al.*, 1965, respectively. Once the samples were analysed statistical tools were applied to identify the soils which are deviating from the normalcy. Soil test reports were prepared and distributed to individual farmers through a public meeting conducted in presence of Sarpanch and village assistants.

Results and Discussion

The soils of Narasimhulapalle village showed a few problematic deviations with respect to tested soil parameters. Most of the soils were light chalka soils, mostly Alfisols with considerably low fertility. The agricultural area constitutes 66% of the total geographical area of village cultivated by 114 farmers of different educational backgrounds. Though farmers reported low yields in a few fields attributing to salinity, there were no waterlogged fields in the village. Soils were well drained, medium in texture and mostly red soils. The following is the inference drawn from the soil analysis of the village.

Soil Reaction: The pH of the soils varied between 4.48 and 8.76. However, 90 % of the soils indicated a normal unproblematic pH values (USSL,1954) while 10% soils were found to be acidic at different magnitudes (Fig.2). Except in a single sample there were no alkaline fields in village. There were a few pockets in fields varying from slightly acidic to strongly acidic, thus inviting reclamation procedures. The farmers were ignorant to the concept of acidity; the reason for low yields in certain pockets as inferred by farmers was identified and related to acidic soil reaction.

Electrical conductivity: The electrical conductivity of the soils of the village varied between 0.01 and 1.83 dS m^{-1} (Fig 2). There were no soil samples falling in the problematic category as given by SSSA, 1987.

Available Nitrogen: The soils of village are extremely low in status of available nitrogen ranging from 20.9 to 94.1 kg ha^{-1}. None of the soils were found sufficient in nitrogen. Continuous paddy cultivation with no addition of organic manures, stubble burning and non incorporation of stubbles in cotton grown fields could be reason for such alarming levels of nitrogen (Table 2).

Available Phosphorus : Thirteen percent of the soils were low in available 'P' status while 44.7% of the samples were medium in 'P' and the remaining 42.1% recorded high P status. Dominantly medium to high 'P' status of the fields could be probably due to, increased utilization of DAP which has more P percent rather than opting for direct 'P' fertilizers like single super phosphate. Besides, ignorance of farmers on use of DAP for top dressing in paddy could be also another reason attributing to very high P levels (> 100 kg ha^{-1}) in certain fields.

Available Potassium: Most of the village soils were medium to high in available potassium (97.3%).Only 3 samples recorded low 'K' values (2.6 %). It is important to understand that about 49.1 % of samples showed high 'K' status, despite the fact that farmers seldom apply potassium fertilizers. The potassium rich parent material might have attributed to these high K values of the soils. Application of 'K' fertilizers in any form is not an accepted practice in village which needs to be addressed.

Soil fertility maps: Soil fertility maps were prepared through QGIS software (QGIS Geographic Information System, an open source software, http://qgis.osgeo.org) from the geolocations of the 114 soil sampling sites and displayed in village panchayat. Soil fertility maps with respect to soil reaction, electrical conductivity, available status of N, P and K were prepared and displayed (Fig. 3 to 7).

Recommendations based on soil test reports

On the basis of soil test reports a set of interventions were suggested to the farmers.

- The Soil fertility based fertilizer recommendations were advocated to every individual farmer based on their soil test report for the crop grown
- Owing to very low N statusof soil, the nitrogen should be applied in accordance to the state recommended dosages for realization of yield potential of crop grown.
- Organic forms of nitrogen viz., farm yard manure and compost have to be invariably added (as supported by considerable livestock population in the village).
- Green manure crops must be grown with pre-monsoon showers and incorporated at flowering stage which adds nitrogen to soil besides reducing initial dose of 'N'
- Use of Urea which is a direct and straight N fertilizer is recommended as against popular DAP which imbalances N and P in palnt and soil
- Stubble burning after paddy to be stopped as it depletes the organic matter in soil which is the only natural source of nitrogen.
- Discourage use of DAP and encourage use of single super phosphate as a straight source of 'P'
- Using DAP for top dressing to be stopped

- Campaigning use of ‘K’fertilizers especially muriate of potash as potassium source for every crop grown.

Conclusion

The village adoption program in Narasimhulapalle estimated the fertility status of soil and studied the procedures farmers followed for cropproduction. The soil health reports were distributed to all farmers of the village and suggestions were given to each indicidual farmer through a meeting.

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Table 1. Questionnaire for farmers of the village Headings of columns missing

1			Name of farmer	8	Irrigation: rainfed / tube well/open well
2			Age	9	Geo-positions: Latitude, Longitude
3			Father's name	10	Problem soils in any: Saline / Alkaline / Water logged
4			Mobile number / contact number	11	Crops grown
5			Survey number	12	Previous crop
6			Date of sampling	13	Fertilizers added to previous crops
7			Acreage	14	Organic manures added:
8			Livestock:		

			Type, number		yes/no, if yes which manure, quantity

Table 2.Percentage of soil samples in low, medium and high availability status of available N, P and K

Av.nutrient	Low	Medium	High
N	100.0 %	0 %	0.0 %
P	13.2 %	44.7 %	42.1%
K	2.63 %	48.2 %	49.1%

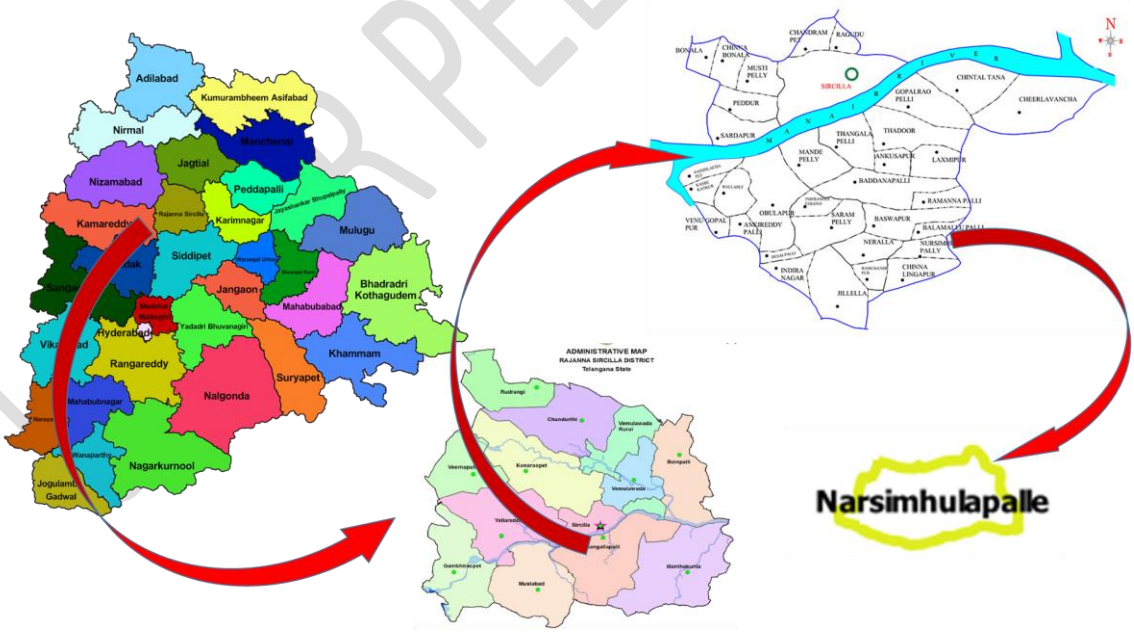

Fig.1. Narasimhulapalle village, Tangallapally Mandal, Rajanna Sircilla Dist, T.S.

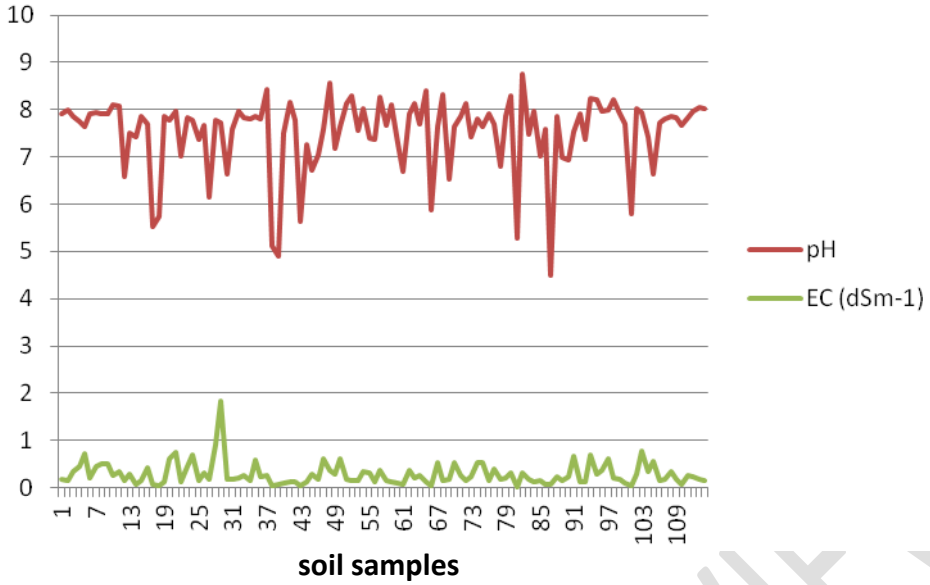

Fig.2. Variations in status of pH and EC of soils of Narasimhulapalle village

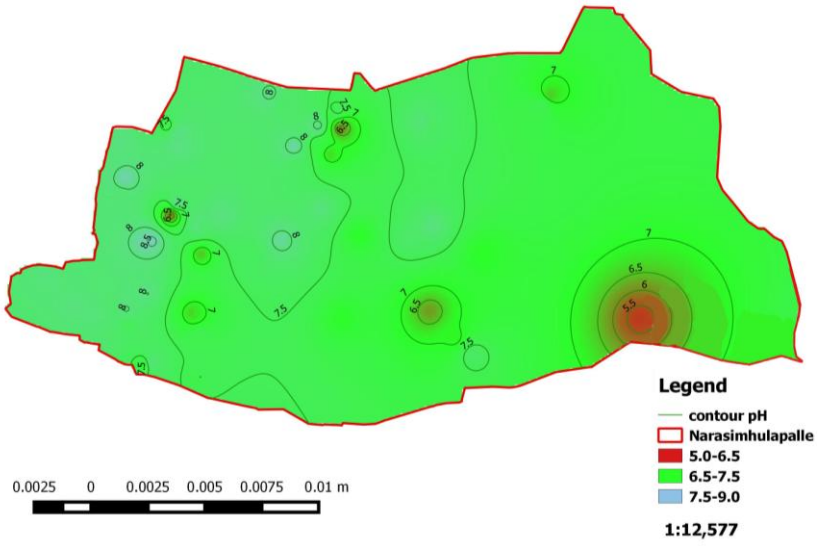

Fig.3. Soil fertility map based on soil reaction

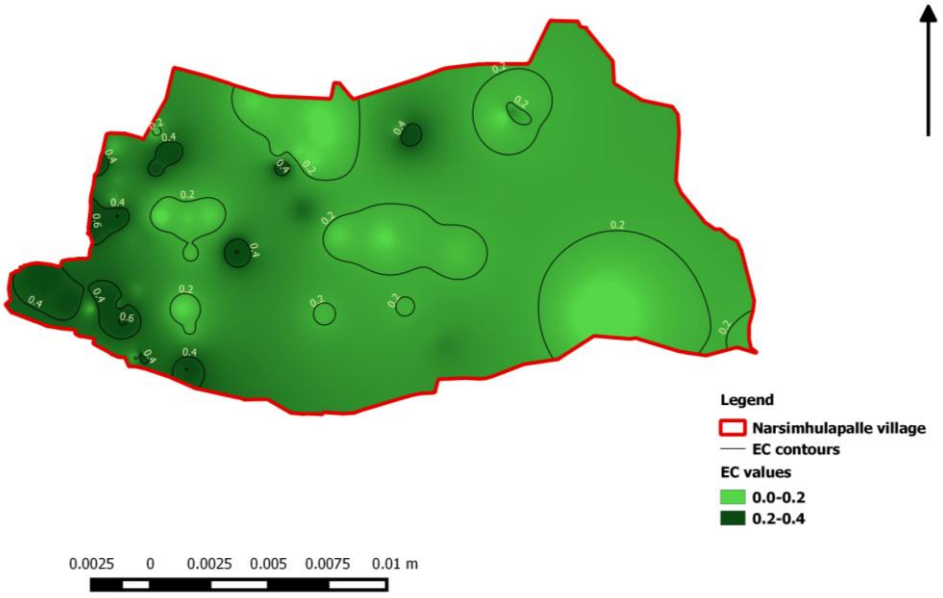

Fig.4. Soil fertility map based on electrical conductivity

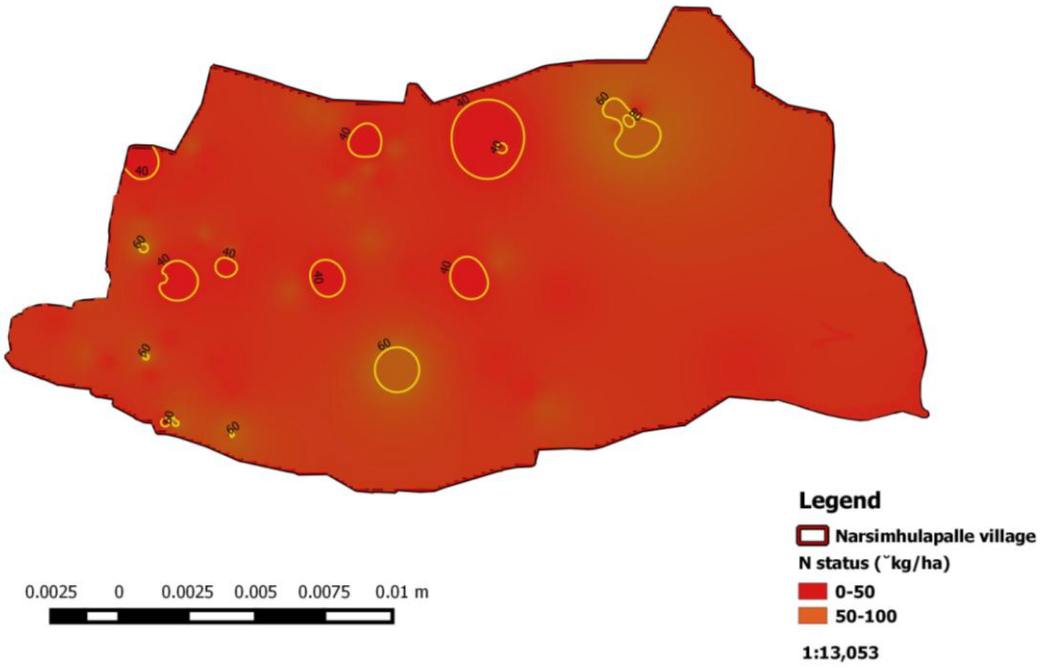

Fig.5. Soil fertility map based on status of available nitrogen

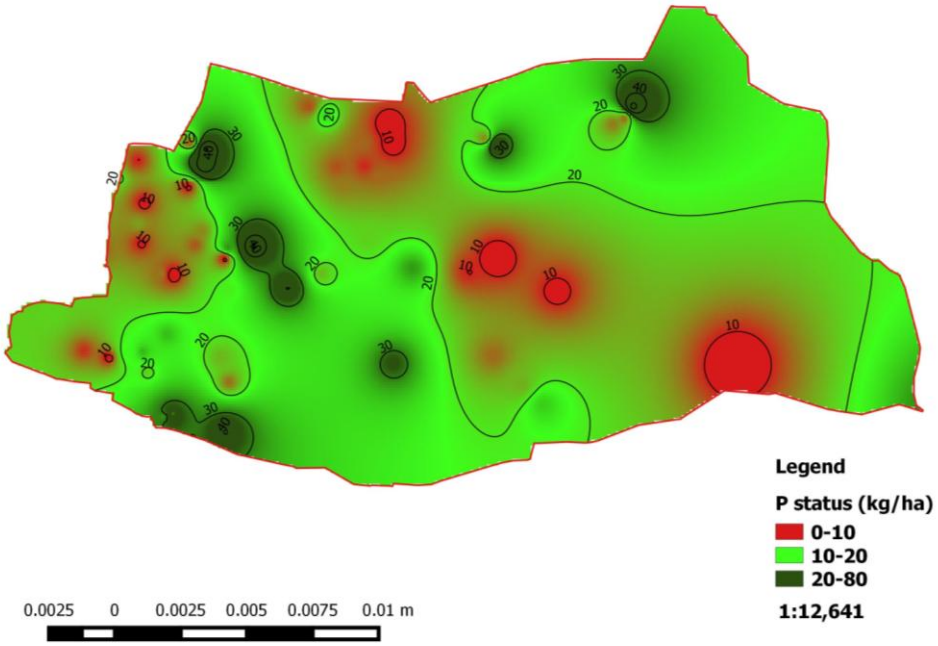

Fig.6. Soil fertility map based on status of available phosphorus

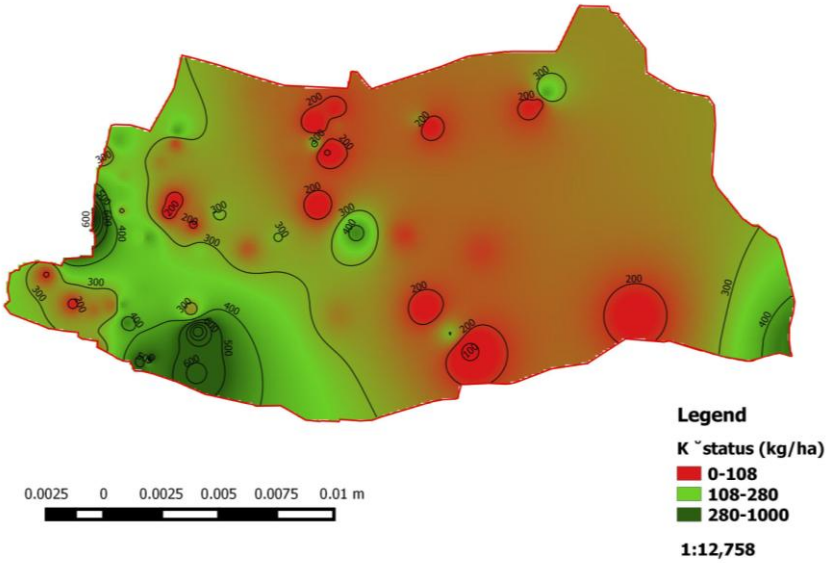

Fig.7. Soil fertility map based on status of available potassium