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Short communication

Impact of inorganic to organic cultivation practices on yield of tea in Darjeeling hills - A case study

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ABSTRACT

Organic cultivation of tea has already started in India. Darjeeling tea has an edge in international and domestic markets. A study was undertaken to compare the traditional and organic cultivation in Darjeeling region in 21 gardens. Yield reduction was 10 to 21.2% during conversion period. In medium and low yielding gardens there was a reduction of upto 29%. However, the quality parameters were quite better with higher price realization.

Key words: Organic cultivation, yield, sustainability, inorganic cultivation, tea.

The concept of organic farming has been getting very popular of late with many advocating a return to traditional methods of agriculture. Organic farming does not imply the simple replacement of synthetic fertilizers and other chemical inputs with organic inputs and biologically active formulations. Tea is comparatively a new entrant in the field of organic products. Organic tea production involves assisting nature to grow a healthy bush and conserve natural enemies of insect pests, diseases and weeds to minimize crop losses caused by them. This is done by following all modern agronomic practices. The change towards a sustainable farming concept in this perennial plantation tree crop cannot be easily achieved as much as what may possibly be achieved with annual crops on a rotation system of cultivation. A far greater effort and specialized skills are necessary to bring about such a change and yet manage such systems at economic level (Sivapalan, 8).

Around 45% of the tea gardens in Darjeeling have already been converted in organic and a few are under the process of conversion. The loss /gain in the yield after conversion from inorganic to organic has not yet been studied so for in this region. Hence, present study was undertaken to study the post conversion effect on yield of tea.

The study was undertaken in Darjeeling Tea Research and Development Centre, Kurseong, situated at Lat. 26°52'N, Longitude 88°15'E altitude 1349 a.m.s.l. during 2009 to 2010. A questionnaire was prepared and circulated among the certified organic gardens which are already converted to organic cultivation of tea in the Darjeeling hills. The survey was done on 21 organic tea gardens situated at different location of Darjeeling hills. The information provided, was compiled and their pre and post-conversion yield data analysed upto the 6th year after conversion. Average yield has been calculated for all the gardens, *i.e.* pre-conversion and after successive 6 years of conversion. These gardens were further divided into groups/ categories, i.e. high, medium and low yielding gardens on the basis of their performance, *i.e.* productivity. More or less similar nature of organic inputs like manures viz. Compost, F.Y.M., castor cake, vermicompost etc. and bio-pesticides, *viz*. Neem formulations, Verticel® (*Verticillium leucanii*), Bio Power® (*Beuveria bassiana),* Priority® etc. used by all the gardens after conversion.

Overall average yield data of all the organic tea gardens were compiled and yield reduction after conversion for the successive six years have been depicted in Fig. 1 which reveals that before conversion average yield was 562 kg/ha and after conversion from 1st year to 6th year the yield reduced from 10 to 21.2% on an average. It is also observed that initial depression of yield for consecutive three years, which is generally treated as transition period was up to 10% while there was continuous reduction in yield up to 21.2% for the next 3 (three) years, *i.e.* immediately after the conversion period/year. The similar trend was observed by Mohan and Bachi (6).

The gardens kept in the category of high yield (694.8 kg/ha) before conversion (Fig. 2) shows that in the consecutive three years (transition period) reduction in yield was 8% in the first year and third year of conversion while it was 22.6% in the 2nd year of conversion on an average. In the next three years the average yield had gone down by 14 to 34.8% (in the 6th year) after conversion. The gardens categorized as medium yielding, *i.e.* 578.8 kg/ha are depicted in Fig.

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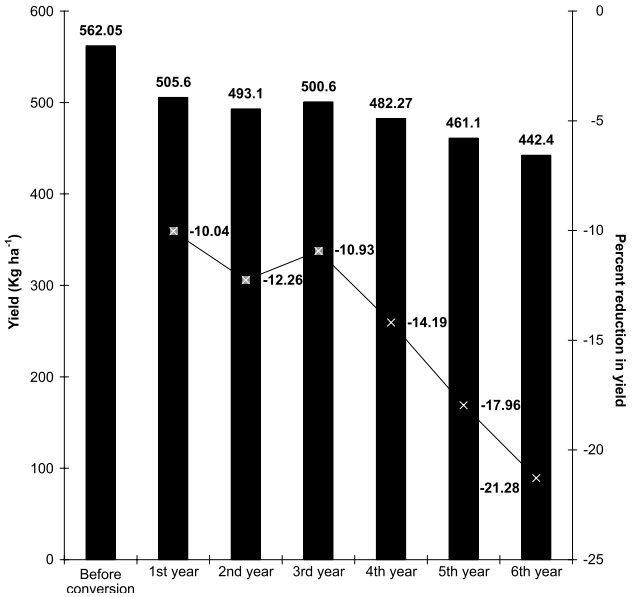

Fig. 1. Overall average yield and persent reduction in yield after conversion from inorganic to organic.

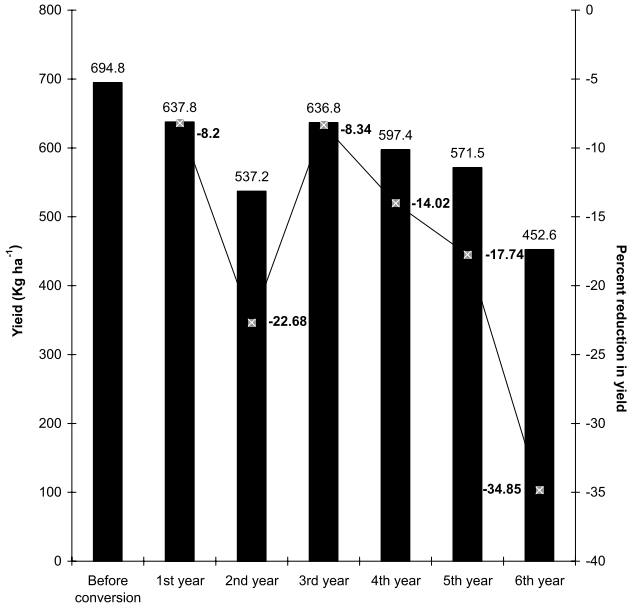

Fig. 2. Average yield of high yielding gardens before conversion and percent reduction in yield after conversion.

3 shows an increase in yield by 6% in the first year after conversion, while in the next successive years from 2nd to 6th year; there was a significant decrease in yield by 6 to 29% respectively. The data presented in Fig. 4 representing the gardens which were having comparatively low yield and categorized as low yielding before conversion shows some interesting pattern of yield after conversion. First consecutive three years after conversion shows drastic increase in yield, *i.e.* 24.6 to 51% while it was steady for 4th and 5th year, *i.e.* 11.7% increase in yield. The observations are well supported by the finding made by Mader *et al.* (5) and Buulsema (2).

A comparative performance of yield recorded in the high, medium and low yielding gardens (Fig. 5) shows some interesting and perplexing trend. Highest yielding gardens whose average yield was 694.8 kg/ha of made tea, the yield declined by 8.2%

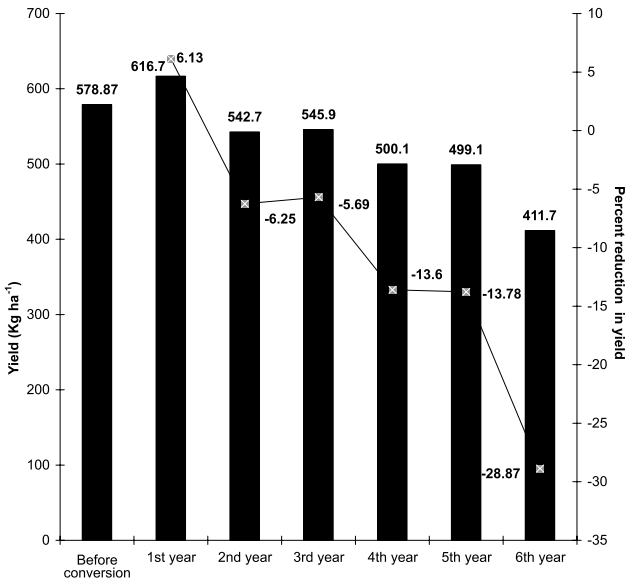

Fig. 3. Average yield of medium yielding gardens before conversion and percent/decrease after conversion.

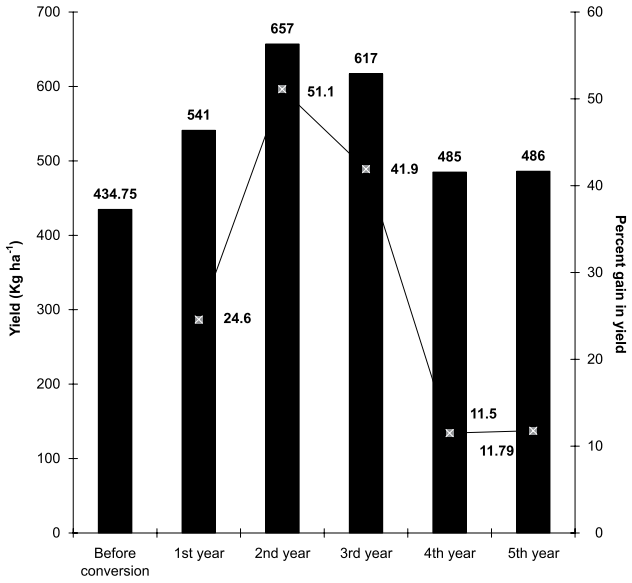

Fig. 4. Average yield of low yielding gardens before conversion and percent increase after conversion.

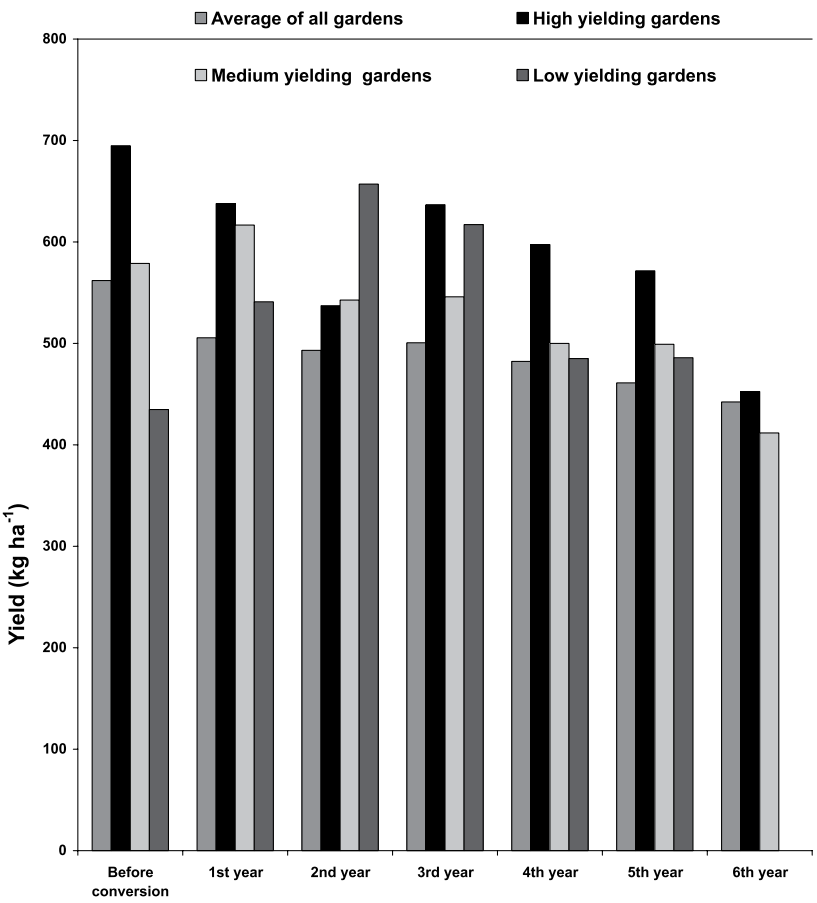

Fig. 5. Comparative performance of organic tea gardens.

in the 2nd year and 22.68% in the 3rd year. But the medium yielding gardens showed a depression of yield by 10.04 and 12.26% in the 2nd and 3rd year, respectively. Interestingly, the lowest yielding gardens whose average yield was 434.75 kg/ha of made tea before conversion has shown an increase of 24.6 and 51.1% increase in the yield during 2nd and 3rd year of conversion, respectively. These phenomena of increasing yield in the lowest yielding gardens as compared to highest and medium yielding was perhaps due to very little inputs used by these gardens before conversion who were nearly sick. After conversion, organic inputs were added nourished the soil well was otherwise deprived of adequate fertilization. However, in high yielding gardens which applied high inorganic inputs/ fertilizers suddenly stopped the same and took recourse to low nutrient content organic inputs/ manures, which resulted in a depression of yield to the extent of 22.68% in the 2nd year. However, in these gardens the yield stabilized to some extent during the 3rd, 4th and 5th years, although the depression of yield ranged from 8.34 to 17.74%. Again in the 6th year after conversion the decline in the yield in the gardens recorded an all time low of 34.85% which cannot be explained at the moment. This definitely indicates to some factors which were beyond the control of the garden management was related to the decline. Though Heeb *et al.* (4) reported that yield of red tomatoes from the organically fertilized plants were significantly lower than yields from plants that received mineral fertilizer. Organic materials are not sufficient to replenish nutrients removed by crop harvest. The complementary use of mineral fertilizers is essential to sustain soil fertility and to achieve increased production (Anon, 1).

The medium yielding gardens also showed more or less the same trend and the depression of yield in the 6th year after conversion was to the tune of 22.28%. However, in the case of low yield gardens the depression in yield was in the 11.79% in the 6th year after conversion. From the above results and trends it can be approximated that all these gardens are lacking in high nutritive value, mineral inputs and as a result there is decline in the yield in all the categories of garden. The yield can be improved by using proper organic inputs which have high nutrient

content and bio-pesticides with high efficacy. It is also noticed that after the 6th year of the conversion, yield pattern of all the three garden categories has stabilized to some extent, which ranges from 442.42 to 486 kg/ha of processed tea, which is well below the Darjeeling average under traditional management system. However, Darjeeling tea is well known for its quality and flavour. The downfall in the yield after conversion from inorganic to organic cultivation may compensate with the quality which is well supported with finding made by Durdane *et al.* (3) who reported that satisfactory tomato yield and quality comparable to those usually found for conventionally grown tomato, could be obtained in organic production system using adequate combinations and rates of organic nutrient sources similarly Singh *et al.* (7) reported that the yield losses could be avoided/ minimized if soil fertility of area to be converted in organic is adequately rehabilitated prior to conversion.

In the context of present study more research on the application of organic fertilizers are necessary in attempts to reduce the application of inorganic fertilizer probably by increasing the frequency of application of organic fertilizers.

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