Journal of Crop and Weed, 10(1):13-18(2014)

Effect of homa organic farming practices on biochemical properties in soil and soybean (*Glycine max*)

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Received:7-11-2013, Revised: 7-5-2014, Accepted: 15-5-2014

ABSTRACT

A field experiment was conducted with eight treatments exposed to Homa atmosphere replicated during kharif season to study the biochemical efficacy of Homa Organic Farming in soybean crop (JS 335) by creating Homa atmosphere. The conventional control (CC) and control without Homa (CWH) were maintained 1 km away. A common basal treatment of cow dung (CD) and cow urine (CW) was given to seeds of Homa treatment. Agnihotra Homa (AH) at sunrise and sunset and Om Tryambakam Homa (OTH) performed for 3-4 h daily yielded smoke and ash were used for seed treatment and for furrow application and Biosol was used for soil and foliar application. Treatment T_3 (Seed treatment with OTH ash, fresh CD and CW + furrow application of OTH ash) was significantly superior over control in case of nodule count and nodule dry weight. The macro and micro nutrients increased in Treatment T_2 (Seed treatment with AH ash, fresh CW and CW + furrow application of AH ash), T_3, T_4 (Seed treatment with AH ash + fresh CW and CW + soil application of Biosol) and T_5 (Seed treatment with OTH ash, fresh CW and CW + soil application of Biosol) was recorded. Soil Zn content and dehydrogenase activity increased over control with treatment T_2 and T_4. Total protein and oil content increased on HT and activities of β-amylase and invertase in soy seeds on soil application of Biosol were superior. Homa smoke, ashes and Biosol thus show promise to the farming community to produce crops with good returns.

Key words: Agnihotra, biosol, homa, soyabean

Soybean [*Glycin max* (L.) Merril], a grain legume, is considered as a wonder crop due to its dual qualities *viz*., high protein content (40-43%) and oil content (20%). Soybean is primarily utilized as a source of protein and oil. The soybean oil comprises mainly mono and polyunsaturated fatty acids like oleic and linoleic acid. Soy protein which is in the range of 39-42 per cent is mostly globulin and partly albumins. Being well suited to black soil, transitional tract of Karnataka, Belgaum, Dharwad and Bijapur districts are the major soybean growing areas occupying 41.2 thousand hectare area with 28.3 thousand tones of annual production. Its cultivation has become popular in southern part of Karnataka due to establishment of processing units and remunerative prices (Anon, 2009).

Excessive use of chemical fertilizer and pesticide in agriculture has received severe criticism from the environmentally conscious people who opined that increase in agricultural production was achieved at the cost of soil health (Cooke, 1982). The environmental degradation due to chemical dependent agricultural practices has made several experts to focus their attention on ecologically sound, viable and sustainable farming system. Organic farming is the only answer which aims at cooperating rather than confronting with nature. Homa Organic Farming which uses organic farming as a base is a zero technology process for betterment of crops and plants in agriculture, horticulture, forestry and microbes and animals. It is a process of purifying the atmosphere through a specially prepared fire which is a special state of matter. It is a smallest Yajnya or Homa (This is a technical term from the Vedic Science of Bioenergy denoting the process of removing toxins from the atmosphere through the agency of life in specially prepared copper pyramid) and forms the basis of Homa Organic farming. The present investigation was, therefore, carried out on soybean with the following objectives:

1. To test the influence of Homa therapy on soil fertility, soil nutrients and soil biological activity.
2. To test the efficacy of AH ash (obtained from Agnihotra Homa performed at sunrise and sunset) and OTH ash (obtained from Om Tryambakam Homa performed 3-4 hour daily) as seed treatment as well as furrow application and efficacy of biosol-Homa biofertilization system in soybean as soil and foliar application.

MATERIALS AND METHODS

A field experiment was conducted during *Kharif* (Rainy), 2009 to study the effect of Homa organic farming practices on soil biochemical property. The experiment was conducted in the Plot No. 49 of C-Block of Institute of Organic Farming, Main Agricultural Research Station, UAS, Dharwad. The

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experimental site is situated in northern transitional zone of Karnataka state and located at 15º26' north latitude, 75º7' East longitude with an altitude of 678 m above mean sea level. The Plot No.174 of G- Block of UAS, Dharwad was selected as control. The topography of experimental site was mixed red and black soil. The soil of experimental site and control was homogenous. Initially the organic carbon in soil was found 0.59 % whereas the available N, P, and K were found 156, 34.8 and 256.3 kg ha^{-1} respectively. The experiment was laid out in completely randomized complete block design (RCBD) with three replications. Organically raised soybean seeds of JS-335 were used. The details of different treatments imposed on soybean seeds of JS-335 are as follows. Treatments T_1: exposed to only Homa atmosphere (creation of smoke in atmosphere after performing Homa to heal the atmosphere) without any treatment, T_2: Seed treatment with Agnihotra Homa ash, fresh cow dung and cow urine + furrow application of Agnihotra Homa ash, T_3: Seed treatment with Om Tryambakam Homa ash, fresh cow dung and cow urine + furrow application of Om Tryambakam Homa ash, T_4: Seed treatment with Agnihotra Homa ash fresh, cow dung and cow urine + soil application of Biosol, T_5: Seed treatment with Om Tryambakam Homa ash, fresh cow dung and cow urine + soil application of Biosol, T_6: Seed treatment with Agnihotra Homa ash fresh, cow dung and cow urine + foliar application of Biosol, T_7: Seed treatment with Om Tryambakam Homa ash, fresh cow dung and cow urine + foliar application of Biosol, T_8: Seed treatment with fresh cow dung and cow urine only. Control without any treatment (T_{10}) and conventional control (T_9) were maintained at 'G' block, where no Homa was performed. For T_9, Thiaram and Carbendazin was used as seed treatment to control soil borne diseases. FYM @ 10 ton ha^{-1} and N:P:K @ 40:80:25 kg ha^{-1} was applied before sowing as basal application. Seeds were dibbed at a spacing of 30 cm × 10 cm. For controlling weeds two hand weeding and two hoeing were carried out. Hexoconozole @ 1 ml liter^{-1} of water for rust and Chloropyriphos @ 2 ml liter^{-1} of with neem based pesticides @ 5 ml liter^{-1} of water were sprayed at 40 and 60 DAS (Days after sowing).

Ninety grams of Agnihotra Homa Ash and Om Tryambakam Homa Ash were used for a plot size of 18 sq.m. For preparation of Biosol, 5 kg of Agnihotra Homa Ash in 200 liter of water was used and incubated for 30 days in air tight plastic drum. Four liters of unfiltered solution of diluted Biosol (1:15) was used as soil application (T_4 & T_5) whereas 4 liters of filtered solution were used as foliar application (T_6 & T_7).

The nodule count and nodule dry weight (g) of soybean crop at 45 DAS was determined by uprooting five plants in random from each plot. Straw yield and grain yield from each plot after harvest were recorded in kg ha^{-1}.Soil organic carbon (%), Available N, P, K (kg ha^{-1}) and micronutrients Cu, Zn, Mn and Fe (mg kg^{-1}) were estimated from soil sample collected after harvest of soybean crop. Soil dehydrogenase activity from rhizosphere soil collected after harvest of soybean crop was carried out and expressed in (µg of TPF formed g^{-1}24 h^{-1}). Specific activity of enzymes (β-amylase and invertase) of soybean seeds germinated up to 72 h was determined.

RESULTS AND DISCUSSION

The results of significant effect of different treatment of Homa Organic Farming were observed on biochemical property of soybean (JS 335) and soil is discussed hereunder. In case of straw yield and grain yield, only small increase (5%) was registered in treatments T_4 and T_5 with respect to conventional practices without Homa (T_9). Whereas treatment T_7, showed maximum straw yield (1492 kg ha^{-1}) and grain yield (994 kg ha^{-1}) which were on par with T_6 (1472 kg ha^{-1}) and (981 kg ha^{-1}). Higher grain yield and straw yield with the application of Homa treatment may be due to adequate amount of both macro and micro nutrients available in root zone (Table 1) which probably enhanced crop growth and yield due to treatment as reported by Nimje and Seth (1987) in soybean crop who observed higher number of branches per plant, dry weight per plant as compared to control. The increase in growth contributory character due to application of Agnihotra Homa ash as seed treatment and soil application of Biosol might have provided adequate nutrients in soil which might have resulted in enhanced crop growth. The data on nodule count and nodule dry weight (g) at 45 DAS and macronutrients and micronutrients in soil after harvest are furnished in table 1 and table 2 respectively. Seed treatment with Agnihotra Homa ash followed by soil application of Biosol (T_4) registered maximum nodule count (42) and nodule dry weight (1.74 g) differed significantly from T_9. Treatment T_{10} recorded minimum nodule count (15) and dry weight of nodule (0.64 g), differed significantly from T_1 (21). It may be seen from the recorded data that nodule count and nodule dry weight was significantly higher in Agnihotra Homa ash treatment but not with Om

Tryambakam Homa ash. Both the treatments did not affect the nodule count which was on par with their control T_8. The results on the nodule count and dry weight of nodules reveal that Agnihotra Homa ash had a better effect over Om Tryambakam Homa ash.

Seed treatment with Agnihotra Homa ash followed by furrow application of Agnihotra Homa ash (T_2) registered maximum organic carbon (0.83%), Zn (0.68 mg/kg) and Fe (9.41 mg/kg). This treatment differed significantly from T_9. Control without Homa (T_{10}) showed minimum soil organic carbon (0.68 %), minimum Zn (0.26 mg kg^{-1}) and minimum Fe content (6.27 mg kg^{-1}) in the soil and differed significantly from $T_{1.}$ Seed treatment with Agnihotra Homa ash followed by soil application of Biosol (T_4) recorded maximum available N (192 kg ha^{-1}), P (34 kg ha^{-1}), K (501 kg ha^{-1}), copper content (1.47 mg kg^{-1}), and Mn content (9.76 mg kg^{-1}) in the soil and differed significantly from T_9. Control without Homa (T_{10}) recorded minimum available N (167 kg ha^{-1}). P (21 kg ha^{-1}), and K (481 kg ha^{-1}) in the soil. Minimum copper content (0.93 mg kg^{-1}) minimum Mn content (6.4 mg kg^{-1}) and minimum Zn content (0.26 mg kg^{-1}) was found in T_{10} which was on par with T_1. The significant increase in the organic carbon, available N, P and K and in micronutrients like Cu, Zn, Mn and Fe points out the positive effect of Agnihotra ash in making the soil rich by way of making more macro and micronutrients available. Among various treatments, variation in available nitrogen, phosphorus, and potassium and organic carbon with the application of organic treatment receives support from the Giraddi (1993). The increase in nitrogen availability may be attributed to improved soil properties and nodulation due to Homa treatments which might have led to enhanced N-fixation and mineralization of organic N. Furrow application of Homa ash recorded higher content of available potassium (T_2 and T_3) receives support from Nalawadmath *et. al.* (2003) who had observed build up of maximum available K (33%), only in organic treatments in vertisols of Bellay. Application of Homa organic ash plays a major role in dissolution of native phosphorus compound. Incorporation of organic matter in the soil in the form of Biosol in combination with Homa ash might have increased availability of soil phosphate due to chelation of Fe and Al by metabolites of microbial decomposition which are responsible for the phosphate fixation in soil, organic acids during decomposition of organic manure which might have had favourable effect in converting insoluble form of phosphorus to soluble form. Hence increased availability of phosphorus in the soil might have contributed to higher uptake which might have favoured better growth and yield parameters due to Homa (Gardner *et .al*, 1988). The observations of Sharma (2000) on organic manuring, Palekar, (2006) on Jeevamruta and Beejamruta, Swaminathan *et. al*. (2007) on Panchagavya and Yankaraddy *et. al*. (2009) on organic sources from coffee pulp compost, rice hull ash and FYM lend support to the observations of this investigation on enhancement in the availability of macro and micronutrients due to organic inputs including Homas ash and biosol. In the present investigation Cu, Mn, Zn and Fe registered very high value. It has been reported in the scientific literature that these micronutrients are essential for biological function. The micronutrient status when reviewed with respect to the Biosol application in soil (T_4 and T_5), revealed 45-46 % increase in case of Cu and Mn, but Fe registered moderate i.e. 17 % increase. The Zn status was alarmingly high in T_4 (140 % increase) and in T_5 (67 % increase).

The Treatment T_4, showed maximum dehydrogenase activity (5.3) which differed significantly from T_5 (3.6). Minimum dehydrogenase activity (0.90) was recorded in T_{10}. Quantification of dehydrogenase activity has been recommended as a useful indicator of biological activity in soil (Schaffer, 1993). This observation on increase in Zn content in T_4 and T_5 goes well with the observation on soil dehydrogenase activity which registered 342 % increase in T_4 and 200 % increase in T_5 (Table 3). Increase in dehydrogenase activity observed in Biosol treated soil receives support from the unusually high content of Zn in the same soil. Since Zn is an integral part of NAD^+ and $NADP^+$ dehydrogenases, it may be inferred that Agnihotra Homa Ash in combination with Biosol might have increased the Zn content in the enriched soil which in turn, might have shown very high activity of soil dehydrogenase. The results of Singaram and Kamalakumari (1995) lend support to the observations of this investigation on the activities of dehydrogenase and other enzymes that higher activity of dehydrogenase, urease and phosphatase was recorded in FYM treatment over inorganic treatment in a long term experiment on soil enzymes related to C, N, and P cycling.

Treatment T_4 showed maximum β-amylase activity (2.65) after 24 h of germination, and (3.21) after 48 h of germination which were on par with T_5. However, after 48 h of germination, β-amylase

Table 1: Nodulation (45 DAS), straw and grain yield of soybean crop under different treatments

Treatment	Nodule count plant^{-1}	Nodule dry weight plant^{-1} (g)	Straw yield (kg ha^{-1})	Grain yield (kg ha^{-1})
T_0	21	1.01	1255	837
T_1	35	1.53	1305	870
T_2	31	1.50	1322	881
T_3	42	1.74	1411	940
T_4	39	1.36	1447	964
T_5	27	1.19	1472	981
T_6	22	1.18	1492	994
T_7	31	1.34	1261	840
T_8	20	0.88	1408	938
T_9	15	0.64	1183	788
SEm(±)	**1.54**	**0.06**	**10**	**7**
LSD (0.05)	**4.56**	**0.17**	**32**	**21**

Table 2: Nutrient status of soil after harvest of soybean crop as influenced by different treatments

Treatment	Macronutrients				Micronutrients			
	Organic carbon (%)	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})	Cu (mg kg^{-1})	Zn (mg kg^{-1})	Mn (mg kg^{-1})	Fe ((mg kg^{-1})
T_1	0.75	168	22	481	0.99	0.27	6.46	7.25
T_2	0.83	185	24	499	1.44	0.68	7.86	9.41
T_3	0.79	184	30	492	1.08	0.61	7.55	9.0
T_4	0.78	192	34	501	1.47	0.65	9.76	8.98
T_5	0.77	189	22	491	1.44	0.44	9.29	8.89
T_6	0.77	180	23	482	1.03	0.37	6.95	7.33
T_7	0.77	180	22	486	1.02	0.28	6.74	7.61
T_8	0.76	178	24	481	1.01	0.27	6.74	7.65
T_9	0.72	181	24	485	1.09	0.37	6.98	8.18
T_{10}	0.68	167	21	481	0.93	0.26	6.46	6.27
SEm(±)	**0.01**	**1.39**	**0.73**	**2.40**	**0.13**	**0.04**	**0.29**	**0.27**
LSD (0.05)	**0.04**	**4..13**	**2.16**	**7.15**	**0.39**	**0.11**	**0.87**	**0.79**

activity was found to be increased in all the treatments. Minimum β-amylase activity was recorded in T_1 (1.70) which differed significantly from T_{10} (1.95) after 24 h of germination whereas after 48 h of germination minimum β-amylase activity (1.95) was found in T_8 which was on par with T_{10} but differed significantly from T_1 to T_7. After 72 h of germination seeds of soybean exhibited decreased β-amylase activity in all the treatments, where T_5 showed maximum β-amylase activity (2.90) which differed significantly from T_4, (2.70). Treatment T_{10} showed minimum β-amylase activity (1.74) and differed significantly from T_1 (2.1). Treatment T_4 showed maximum residual activity (2.63) in non germinated dry seed of soybean. T_{10} showed minimum β-amylase activity (1.73) in non germinated soybean seeds. In case of invertase, T_5 showed maximum invertase activity after 24 h (1.08) and 48 h (3.27) of germination of soybean seeds, but was on par with T_4 (1.01). Treatment T_{10} showed minimum invertase activity at both the cases. After 72h of germination of soybean seeds, maximum invertase activity was recorded in T_6 (2.31) which were found to be significantly different from T_7 (1.71). Minimum activity was recorded in T_{10} (4.45) which

Table 3: Soil dehydrogenase activity, specific activity of β-amylase and invertase as influenced by different treatments

Treatment	Dehydrogenase activity (μg of TPF formed/g^{-1}/$24h^{-1}$)	Specific activity of β-amylase (μg of maltose produced /min/mg of protein)				Specific activity of invertase (μg of glucose produced /min^{-1}/mg^{-1} of protein)			
		Normal seeds	Germination			Normal seeds	Germination		
			24 h	48 h	72 h		24 h	48 h	72 h
T_1	1.0	2.04	1.70	2.20	2.10	1.89	0.79	1.87	1.79
T_2	4.0	2.09	2.02	2.29	1.94	1.99	0.74	2.07	1.85
T_3	3.4	2.42	2.44	3.06	2.29	2.23	0.89	2.04	1.95
T_4	5.3	2.63	2.65	3.21	2.70	2.09	1.01	2.77	2.30
T_5	3.6	2.61	2.52	2.99	2.90	2.53	1.08	3.27	2.20
T_6	2.6	2.38	2.54	2.95	2.45	1.95	0.76	2.33	2.31
T_7	1.5	2.21	2.44	2.54	2.21	1.83	0.69	1.98	1.71
T_8	1.2	1.78	1.88	1.95	1.86	1.49	0.84	1.80	1.60
T_9	1.4	1.83	2.00	2.14	1.74	1.77	0.86	2.13	1.77
T_{10}	0.9	1.73	1.95	1.96	1.74	1.53	0.57	1.63	1.45
SEm(±)	**0.23**	**0.04**	**0.08**	**0.06**	**0.04**	**0.05**	**0.04**	**0.07**	**0.11**
LSD (0.05)	**0.68**	**0.11**	**0.23**	**0.19**	**0.14**	**0.11**	**0.12**	**0.21**	**0.32**

differed significantly from T_1 (1.79). The residual activity of invertase in non-germinated dry seeds of soybean was found to be maximum in T_5 (2.53), differed significantly from T_4 (2.09). Minimum invertase activity (1.49) in non-germinated seeds of soybean was recorded in T_8 which was found to be on par with T_{10} (1.53) but differed significantly from T_1 and T_9 (Table 3). Germination and seedling emergence have a high demand for energy via respiration of energy food reserves. The increase in germination percentage of soy seed observed in this investigation due to Homa treatments over control without Homa and increase in the activity of hydrolytic enzymes, b-amylase and invertase correlates well with the increased efficacy of soybean due to Homa treatments. Paper chromatographic studies carried out by Suda *et. al.*, (1986) on the enzymatic activities during the growth of germinating soybean reveal that only maltose was found in all the germinating soybean digests and concluded that most of the detectable amylase activity from soybean seedlings corresponded with β-amylase.

It may be concluded that Agnihotra homa atmosphere alone was not sufficient to increase nodule number, higher nodule weight per plant, dehydrogenase activity and macro and micronutrient status of the soil. The only remarkable increase registered in case of macronutrients by homa control was in organic carbon, whereas in case of micronutrients it was in Fe content as compared to control without homa. The many-fold increase in the soil dehydrogenase activity indicated the fertile status of the soil and its richness in microbial status after receiving homa treatments. Among all the homa treatments (T_2-T_7), the soil application of Biosol (T_4 and T_5) was superior in increasing all the parameters studied. Soil application of Biosol also increased root nodules maximally as compared to other homa treatments and homa control. Notable increase in the organic carbon, available N, P and K and Cu, Zn, Mn and Fe points towards the positive effect of homa ashes in making the soil rich by way of making available more macro and micronutrients. The use of Biosol along with homa ashes, especially Agnihotra homa ash provides a promising supplement at a very low cost affordable even by poor and marginal farmers. The study clearly indicates the usefulness and potential of 'Homa therapy' or HOF practices over conventional chemical methods of cultivation in soybean. Studies on other grains, vegetables and fruits are in progress under HOF.

REFERENCES

Anonymous, 2009. Oil seed crops, In: *Handbook of Agriculture,* ICAR, New Delhi, 6th Edn., Pp. 1143-44.

Cooke, G.W., 1982. *Fertilizing for Maximum Yield*, 3rd edn., Garanda, London, pp. 120-135.

Gardner, F.P., Pearce, R. b. and Mitchell, R.L., 1988, Mineral nutrition, In: *Physiology of Crop Plants,* Scientific Publishers, Jodhpur, pp. 98-131.

Giraddi, R. S., 1993, Vermi compost and its role in agriculture. In : *Proc. Course on Use of Biofert. Tr. Prog.* for the Officers of the State Department of Agriculture, Karnataka, 18-22 October, 1993, Univ. Agric. Sci., Dharwad, Karnataka, Pp. 50-54.

Nalatwadmath, S. K., Ramamohan Rao, M. S., Patil, S. L., Jayaram, N. S., Bhola, S. N. and Prasad, A., 2003. Long-term effect of integrated nutrient management on crop yields and soil fertility status in vertisols of Bellary. *Indian J. Agric. Res.,* **37**: 64-67.

Nimje, P. M. and Seth, J., 1987, Effect of phosphorus and FYM on soybean and their residual effect on succeeding winter maize. *Indian J. Agric. Sci.,* **57**: 404-09.

Palekar, S., 2006. *Shoonya Bandovalada Naisargika Krushi,* Swamy Anand, Agri Prakashan, Bangalore.

Schaffer, A., 1993, Pesticide effects on enzyme activities in the soil ecosystems. In : *Soil Biochemistry*, *(Ed.) Bollog, J. M. and Storzky, G.* Maral Dekkar Inc., New York.

Sharma, M. P., Bali, S. V. and Gupta, D. K.. 2000. Crop yield and properties of inceptisol as influenced by residue management under rice-wheat cropping sequence. *J. Indian Soc. Soil Sci.,* **48**: 506-09.

Singaram, P. and Kamalakumari, K., 1995. Long-term effect of FYM and fertilizers on enzyme dynamics of soil. *J. Indian Soc. Soil Sci.,* **43** : 378-81.

Suda, M., Watanabe, T., Kobayashi, M. and Matsuda, K., 1986. changes in starch content and related enzyme activities during growth of germinating soybeans, *Agric. Biol. Chem.,* **50** : 3195-96.

Swaminathan, C., Swaminathan, V. and Kennedy, R., 2007. *Panchagavya,* Kissan World, July, 2007, **34** : 57-58.

Yankaraddy, H., Dineshkumar, M. and Madaiah, D., 2009. Effect of coffee pulp compost and rice hull ash on growth, yield and nutrient uptake in rice. *Karnatka J. Agric. Sci*., **22**: 751-54.