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Research Article

Yagya with Gayatri Mantra results in higher seed germination and seedling growth of *Tritieum aestivm* (wheat)

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Abstract. The present study records the effect of traditional Vedic Yagya on germination and consequent development of wheat seeds and seedlings. Two sets of studies on the seeds were conducted simultaneously. In one study, one set of wheat seeds were exposed to the Yagya procedure. The other set of wheat seeds was exposed to normal conditions of growth and smoke from regular mango (mangifera indica) wood smoke in an adjacent chamber. The seeds were thus treated for 4 days and on 6th day seed germination was recorded. The germination rate index was 85.08% in seeds that were exposed to Yagya fumes as compared to 48.15% in seeds that were not. The coefficient of velocity of germination was 77.021% and 36.076% in seeds kept in the presence and absence of Yagya respectively. The mean germination time has been reported to be 1.29 days in the seeds that were exposed to Yagya fumes and 2.77 days in seeds that were exposed to normal mango wood fumes minus any yagya processes. In the other study, seeds were first germinated in the presence of Yagya procedure and then exposed further in the presence and absence of Yagya to observe the effect on seedling development. The growth of root length and shoot length were 11.875 cm and 11.762 cm respectively in the pre-germinated seeds which were kept in presence of Yagya while the growth of root and shoot length were 8.352 cm and 7.904 cm respectively in the pre-germinated seeds that kept in absence of Yagya. The study found that the presence of Yagya had a significant impact both on the wheat seed germination and seedling development.

Keywords. Yagya, Seed germination, Seedling Development, Gayatri Mantra, Sustainable development, Wheat, Fertilizers

Introduction

Indic culture counts Yagya as the bedrock of the holy set of 4 texts that make up Vedas and subsequent Veda-inspired literature. Since millennia, varied Yagya procedures have held a hallowed place in the collective memory of Indian subcontinent. This procedure involving fire, herbs and mantras has been performed for therapy – as in Ayurveda, maintaining ecological balance as well as attaining temporal and spiritual goals (1).

The Vedic system considers Yagya as the key to attain and maintain sustainable ecological development. "Vasudhaiv Kutumbakam" is the common denominator amongst all Vedic and Veda inspired belief system. This corresponds to the entire Earth community as one family – a family that includes all the inhabitants of the planet, including plants and animals (2). Thus, following the Vedic thought, it is mandatory to administer health and wellbeing to plants and animals too.

Bheshaj Yagya translated here as Pharmacological Yagya processes are well delineated in prominent Ayurvedic texts as herb-infused fume therapy for humans and the rest of the environmental elements alike (3-7). The process of Yagya has been confirmed as therapy by Maharshi Charak as well (Charak Samhita 1/15/56) and Sushrut Samhita (Sushrut Samhita 1/1/5) (1).

Saxena M. et.al., investigated impact of Yagya on particulate matters and reported that Yagya technique showed trend of decrease of PM2.5, PM 10 and CO2 after performing Yagya (8).

Soil health is a major cause of concern in today's world. The extensive use of pesticides and insecticides in agricultural production can degrade and damage the community of micro flora living in the soil, particularly when these chemicals are overused or misused. According to a study it has been observed that people have no choice but to buy more and more chemical fertilizer because the land for crop production is reducing day by day (9).

Numerous studies have highlighted the destructive effects of pesticides on soil ecology which includes microorganisms and biochemical processes involves in it. There have also been studies that have found that the residue of some pesticides can be degraded and assimilated by microorganisms. The long-term pesticide applications can disturb and damage the biochemical processes of nutrient cycling (10-13). As per the scripture, Yagya is the best solution to attain the sustainable environment development to again establish the soil ecology and increase in natural fertility of the soil. In the present study, effect of Yagya was seen on the seed germination and seedling development testing a Vedic hypothesis on ecological balance through positive impact on plant growth.

Methods

Materials

The sacrificial fire altar – Yagya Kund, was prepared using indigenous material, sourced locally.

Regular kiln fired clay bricks, soil, wet cow dung - gobar (for daubing), and cow urine –gomutra, went into the setting up of the yagya kund. Care was taken to source the gobar and cow urine from cows that produce A2 type of milk. A2 type cows are indigenous breed of cows that have not undergone genetic mutation since past 5000-10000 years back. This fact was important for the experiment, as the continuity of breed is maintained – in order to access their eliminatory products – in the same manner, as was done in the Vedic era.

A coarsely powdered herb mix - havan samagri – the biomass that went for oblations in the fire was sourced from Gayatri Shaktipeeth, Ujjain. The fire in the Yagya Kund was generated by lighting up dried and infestation-free wooden samidha of mangifera indica –mango tree. Samidha are the mango wood sticks used as base material to generate Yagyagni – the sacrificial fire. Cow ghee of well-known Govardhan brand, was used for ahutis – oblations to fire. Ghee is a food staple in Indian homes and is also known as clarified butter. Wheat seeds were bought

from local market of Ujjain. The river water used in this process was sourced from the Ganges.

Preparation of Yagya kund (sacrificial fire altar)

The shape of Yagya kund is very sensitive towards the effect of Yagya performed. According to the Rigveda the shape of Yagya kund of Yagya performed for environmental health must be in shape of ASHT DAL KAMAL. Translated in English, Asht dal kamal is lotus (Nelumbo nucifera) flower with eight petals. Lotus is an oft-recurring imagery pertaining to ultimate purity in Indian philosophy. For the experiment, the octagonal structure of yagya kund was inferred from the ashta dal reference.

The Yagya kund of octagonal shape was prepared (Figure 1). The Yagya kund preparation had following considerations:

- Bricks arranged for creating the octagon.
- The bricks daubed generously and uniformly with a solution of gobar and urine of A2 type cow, Yellow soil and Ganga's river water. In the ratio of 3:1:5:1 respectively.
  Structure left to air dry.

Procedure to perform Yagya

The Procedure to perform Yagya was taken from Saral Aur Sarvopyogi Gayatri Yagya Vidhi (14), with minor modifications.

According to the book each preparatory step prior to ahutis (oblations to fire) involves a particular mantra. For the sake of this study, only Gayatri mantra was used throughout the Yagya. Total count of 108 number of Gaytari mantras were given at 8:00 am every 24 hours for 4 days. The sample for testing the effect of Yagya fumes were kept in presence of Yagya fumes while the control was kept in absence in Yagya fumes. The control was subjected to fumes of mango wood only without any mantras or havan samagri. The weight of the mango wood was same as the weight of the wood that was being used in the Yagya chamber, for procedural yagya.

Experiment and control room

Room-1 was for Yagya experiment, and Room-2 was for control i.e. mango-wood-smoke. Both rooms were at the same floor with access to equal amount of sun light and air.

Experimental design

The procedure to study the effect of Yagya on seed germination and seedling development is divided into 4 parts (Figure 2).

Figure 1. Yagya kund prepared and used in the study.

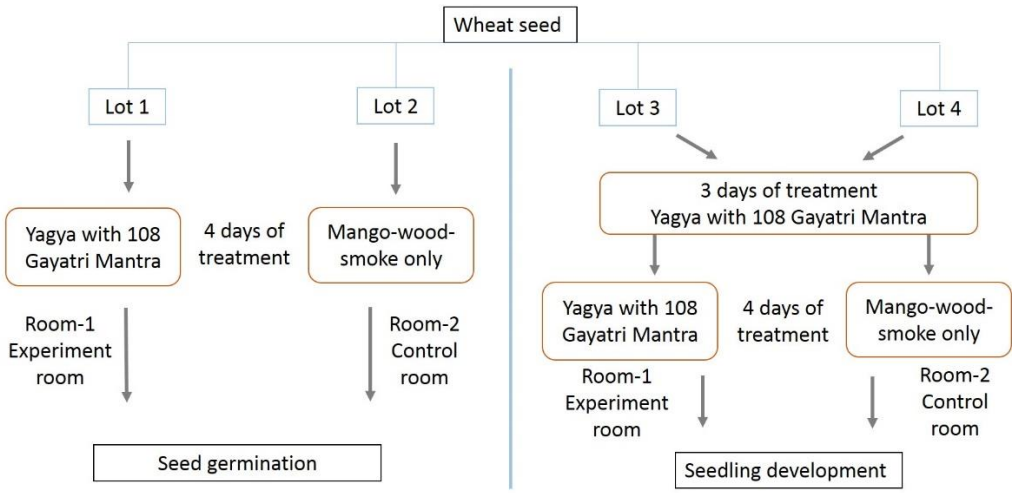

Figure 2: Experimental treatment plan to wheat seed. Total 4 lots were prepared. Lot 1 and 2 were for seed germination experiment and Lot 3 and 4 was for seedling development.

Sample preparation of Wheat seeds and experimental design.

Total 4 lots of wheat seeds had been prepared in which equal amount of seeds had been used. Protocol for sample preparation of Wheat seeds, (step1-3, (15) was as following.

1. The wheat seeds were washed using 75% ethanol for 5 mins then washed 4 times using distilled water.
2. Equal amount of seeds had been kept in bowl with wet tissue paper dampened and with distilled water.
3. Further 5 ml of water had been added making sure seeds do not submerge in water.
4. The lots were labeled as Lot 1 to 4 in which Lot 1 was control for seedling development and lot 2 was sample to observe the seedling development growth in presence of Yagya and lot 3 was control for observing effect of seed germination and lot 4 was sample for observing effect of seed germination in presence of Yagya fumes.
5. For observation of seedling development the lot number 1 and 2 was subjected to Yagya for 3 days once the final germination was 100% they are further subjected to study the effect of seedling development in which Lot 1 acted as control while lot 2 was further subjected to Yagya fumes for next 4 days.
6. For observation of the effect of seed germination Lot 3 was control and Lot 4 subjected to Yagya environment for 4 days.
7. Results were observed every 24 hours till 6 days (16)

Outcome measuring parameter (17,18)

Total 8 types of parameters were used in the present study to measure the outcome of the experiment.

1. Final Germination Percentage (FGP). FGP=Final no. of seeds germinated in a seed lot × 100.
2. Mean Germination Time (MGT) (day). MGT=$\sum f.x/\sum f$; f=Seeds germinated on day x
3. FDG=Day on which the first germination event occurred
4. Last Day of Germination (LDG) (day). LDG=Day on which the last germination event occurred
5. Coefficient of Velocity of Germination (CVG). CVG=N1 + N2 + · · · + Nx/100 × N1T1 + · · · + NxTx. N=No. of seeds germinated each day, T=No. of days from seeding corresponding to N.

6. Germination Rate Index (GRI) (%/day). GRI=G1/1 + G2/2 +· · ·+ Gx/x. G1=Germination percentage × 100 at the first day after sowing; G2=Germination percentage × 100 at the second day after sowing.
7. Time Spread of Germination (TSG) (day). TSG=The time in days between the first and last germination events occurring in a seed lot.
8. The average of root length was calculated using formulae as previously described using surface area (18), shoot length was calculated using scale in centimeter.

Results

Seed germination in the presence and absence of Yagya

Lot 1 was kept in Yagya room where Yagya with 108 Gayatri Mantra was performed every 24 hours for 4 days, while Lot 2 was kept in the control room where mango-wood-smoke was exposed for the same duration to that of Yagya smoke. Total 8 parameters of the outcome of wheat seed germination were recorded (Table 1).

Final germination at the end of 6th day was equal (100%) in both the condition i.e. in the presence and absence of Yagya, however, the rate, time and speed of germination was higher in the presence of Yagya compared to that of in control. The first germination event in the presence of Yagya was achieved on the 1st day itself while it was achieved in the 2nd day in the absence of Yagya. In the presence of Yagya, all seeds were germinated by 2nd day while in its absence, it was achieved by 4th day (Table 1).

Germination rate and speed is more evident with other quantifiable parameters. The lower the mean germination time, the faster is the germination of the population of seeds (17). Our study found that in the presence of Yagya, seed mean germination was very low i.e. 1.29 days while in the absence of Yagya it was nearly 2 fold higher (2.15 fold) i.e. 2.771 days (Figure 3).

Measurement parameter	Control	Experiment
Condition	only medicinal-wood-smoke	Yagya with 108 Gayatri Mantra
Lot	1	2
Final germination percentage (FGP) (%)	100%	100%
Mean germination time (MGT)	2.771 days	1.29 days
First day of germination (FDG)	2nd day	1st day
Last day of germination (LDG)	4th day	2nd day
Coefficient of velocity of germination (CVG)	36.076 %	77.027%
Germination rate index (GRI)	48.15%	85.8%
Time spread of germination	2	1

Table 1. Observation table for wheat seed measurement of germination parameters in presence of Yagya.

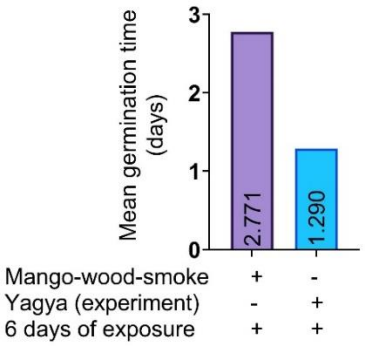

Figure 3. Mean germination time of germinated seeds in presence and absence of Yagya treatment.

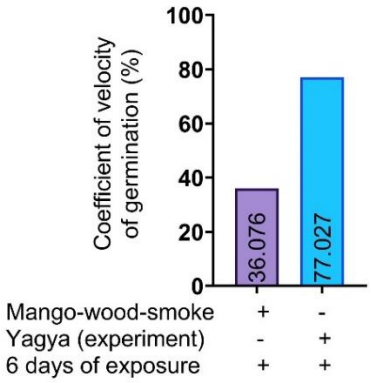

Figure 4. Germination rate of germinated seeds in presence and absence of Yagya fumes.

The rapidity of germination is well defined by the 'Coefficient of Velocity of Germination' (CVG) parameter. Increase in CVG happens when total numbers of seed germination increases and the required time for seed germination decreases (17). The CVG for wheat seed with 4 days of treatment was doubled in the presence of Yagya (77.027%) than compared to control (36.076%) indicating significant impact of Yagya on high seed germination both in terms of quantity and speed (Figure 4).

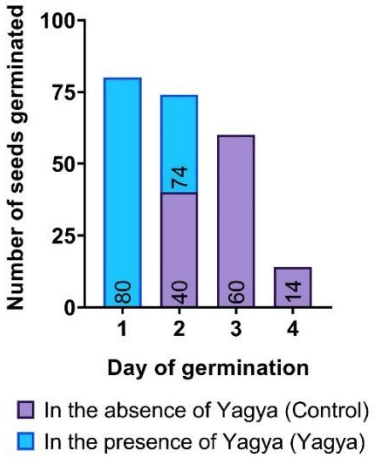

Figure 5. Number of seeds germinated each day in presence and absence of Yagya**.**

Another important parameter for seed germination outcome is the Germination rate index (GRI). Calculation of GI consider both the percentage of germination and its speed. A higher GI value denotes a higher percentage and rate of germination (17). In our study, presence of Yagya had 1.78 fold higher GI (85.8%) than in the absence of it (48.15%) (Table 1; Figure 5).

Time spread of germination (TSG) decides germination speed between the 'fast' and 'slow' germinating lot. In our study TSG was day 1 for the lot in the presence of Yagya while it was day 2 in the absence of Yagya indicating effect of Yagya for a faster germination (Table 1).

Seedling development in the presence and absence of Yagya

In order to measure the effect of Yagya on the seedling development, Lot 3 and Lot 4 were treated differently. First both the lots were kept in the presence of Yagya for 3 days and then lot 3 was continued for 4 days of further exposure of Yagya treatment and lot 4 was moved to control room where it was exposed to mango-wood-smoke for remaining 4 days of control treatment. Average root and shoot lengths were measured on 7th day (Figure 6). The root and shoot lengths were high in the presence of Yagya compared to that of mango-wood-exposure to the seedling after 3rd day indicating effect of Yagya on already germinated seed for seedling development.

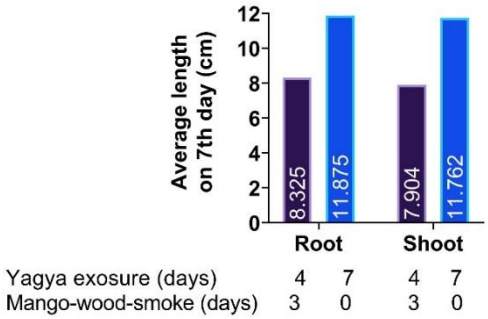

Figure 6. Seedling development of germinated seeds in presence and absence of Yagya

Discussion

According to Vedic literature the treatment of various ailments such as physiological, environmental, emotional and spiritual ailments can be done by using Yagya Therapy (1-8). In the present study, the effect of Yagya on seed germination and seedling development of wheat seed was tested out; it has been found that Yagya has potential positive effects on seed

germination and seed development (Figure 3-6; Table 1). It has been observed that in presence of Yagya fumes the germination rate index was 85.9% while in control it was just 48.15%. In the same way approximately same difference was observed in coefficient of velocity of germination which is 77.021% in presence of Yagya fumes while 36.076% in control. These results show that the process of Yagya has the potential to develop for providing a way to improve plant growth. It can also be used as a viable alternative to the menace of chemical fertilizers after due researches and tests.

In our study, it has been found that Yagya treatment can reduce the mean germination time from 2.77 days to 1.9 days which is approximately half of the time taken by control. According to the investigation on effect of seedling development in presence of Yagya fumes it has been reported that in presence of Yagya fumes more in comparison to control. The average length of shoot was reported to be 11.875 cm in presence of Yagya and 8.35 in control while length of root is 11.762 cm in presence of Yagya and 7.904 cm in control. These results show that the Yagya not only induces high germination rate but also affects the seedling development of wheat.

Previously, studies on different forms of Yagya such as Agnihotra, also known as Homa have shown that Yagya has positive impact on plant growth (19-21) and its ash also had positive impact on water (22) and soil (23-25). Yagya smoke previously had been shown to decrease bacterial count purifying the environmental air (26).

Previously, a study has shown that rice seed germination was better in the presence of full vedic ritual containing mantra than compared to only mantra or only fire (27). In our study we did not study any separate component to see which of them contributed to the seed germination and growth.

Based on our study and other researchers' observations, it can be said that Yagya treatment of seeds can be developed as a practice to promote the growth of wheat and to reduce the use of agriculture fertilizers. It has potential to act as fertilizer as well as to improve the health and quality of the soil by potentially reducing pollutant in the soil and maintaining its pH and concentration of micronutrient present in that, and thus, promoting the development of sustainable agriculture as indicated in the Vedic scripture.

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