



RICE PRODUCTIVITY AND ROADSIDE TREES ALONG HIGHWAYS IN IMPHAL WEST DISTRICT OF MANIPUR: A SCIENTIFIC OVERVIEW

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ABSTRACT

Rice productivity along the five highways of Imphal West District of Manipur, India revealed a marked difference in areas nearer and farther from the roadside. Between the years 2009 and 2010, annual paddy production were found to be differed by an average of 800 to 1050 kg per hectare of the cultivation areas along these highways. Being lined with more or less regular rows of roadside trees of varying species, the difference in rice productivity was supposed to be due to the shade effects of these trees. However, further probe has shown that the most plausible reason for the difference is due to photoperiodism impacted upon by the flashlights of the regularly plying vehicles along these highways.

KEY WORDS: Keywords: photoperiodism, shade and productivity, solarization.

INTRODUCTION

Sustainability, today, has as much importance as the development, more so because of the ever increasing environmental deterioration and massive rise in human population. As one of the most important infrastructural elements of development, roads and highways assume nerve-lines towards efficient mobility. They are not simply thoroughfares for motor vehicles, but must also serve as public spaces where they have profound relationship with the environment (Dixon and Wolf, 2007). The core of the idea is that construction and planning of roads and highways must encompass all the environmental, conservational, economic, social and aesthetic aspects suited to the community. The concern, however, for a sustainable development lies in the fact that human needs are not compromised in the long run. In a more subtle way, infrastructural development should not hamper with sustainability and *vice versa*.

As is in any agrarian economy, rice is the most staple food in the state of Manipur. Interestingly, many rice cultivating areas adjoining different highways in Imphal West District in this state have been reported to give lower paddy productivity as compared to places farther than the roads. The immediate cause assumed is the roadside trees grown along these highways. The present investigation, thus, tried to work out a scientific interpretation of the issue. It aims to incorporate efforts of sustainability in development by hunting out the scientific fundamental of the issue.

MATERIALS AND METHODS

Study area

Imphal West District: Extended as a tiny plain with an area of 519 sq. km. in the central valley of the state of Manipur, Imphal West is the capital of the state. Stretching

North-southward, the district is situated between 24.30° N and 25.00° North latitudes and 93.45° E to 94.15° East

longitudes. It has a mean elevation of 790 m above MSL. The climate of the district is characterized by salubrious sub-tropical, having average annual rainfall of 1085 to 1434 mm which is suitable for rice cultivation. Average temperature of the district varies from 0° C to 36 °C (Laiba, 1992).

The present investigation has been undertaken along three national highways and two state highways running through the district (Fig. 1). These highways along with their lengths within the district are given below:

- 1) National Highway 39 (Imphal Dimapur Road/Indo-Myanmar Road) - 30 km
- 2) National Highway 53 (Imphal Silchar Road/Imphal Jiribam Road/New Cachhar Road) – 12.55 km
- 3) National Highway 150 (Ukhrul Aizawl Road/Tiddim Road) – 14 km
- 4) Imphal Kangchup Road (IK ROAD) – 18 km and
- 5) Imphal Mayang Imphal Road (IM ROAD) – 24 km

These highways are commuted under all weather conditions throughout the year. They are the most viable mode of transport for goods and men in the district as well as in the state of Manipur.

Roadside trees along the highways

All the five highways under study are characterized by more or less regular growth of mature roadside trees on both sides. All in all, there have been counted a total of 4691 trees at the time of observation. The trees are comprised of both native as well as exotic species which have been introduced in recent times only (Nermeshori, 2011). Being similar in Sun's orientation, these trees cast varying amount of shade upon the adjoining rice fields. Based on the inventory of roadside trees, it was also found that the highways have much higher weighted average in terms of their length.

Rice cultivation along the highways

Major stretches of the highways under study pass through intensively managed rice fields on either sides. Along the routes, areas having similar orientation to the sunrise and sunset remain under rice cultivation throughout the growing season. Collective responses, in this regard, from concerned farmers have revealed that most of the crops

adjoining the roadside trees has lesser productivity than the same reared in farther fields from the roadside. Moreover, it has also been observed that rice plants growing along the areas adjoining the roadside were characterized by broader and thinner leaves as well as less maturity in the seeds harvested henceforth.

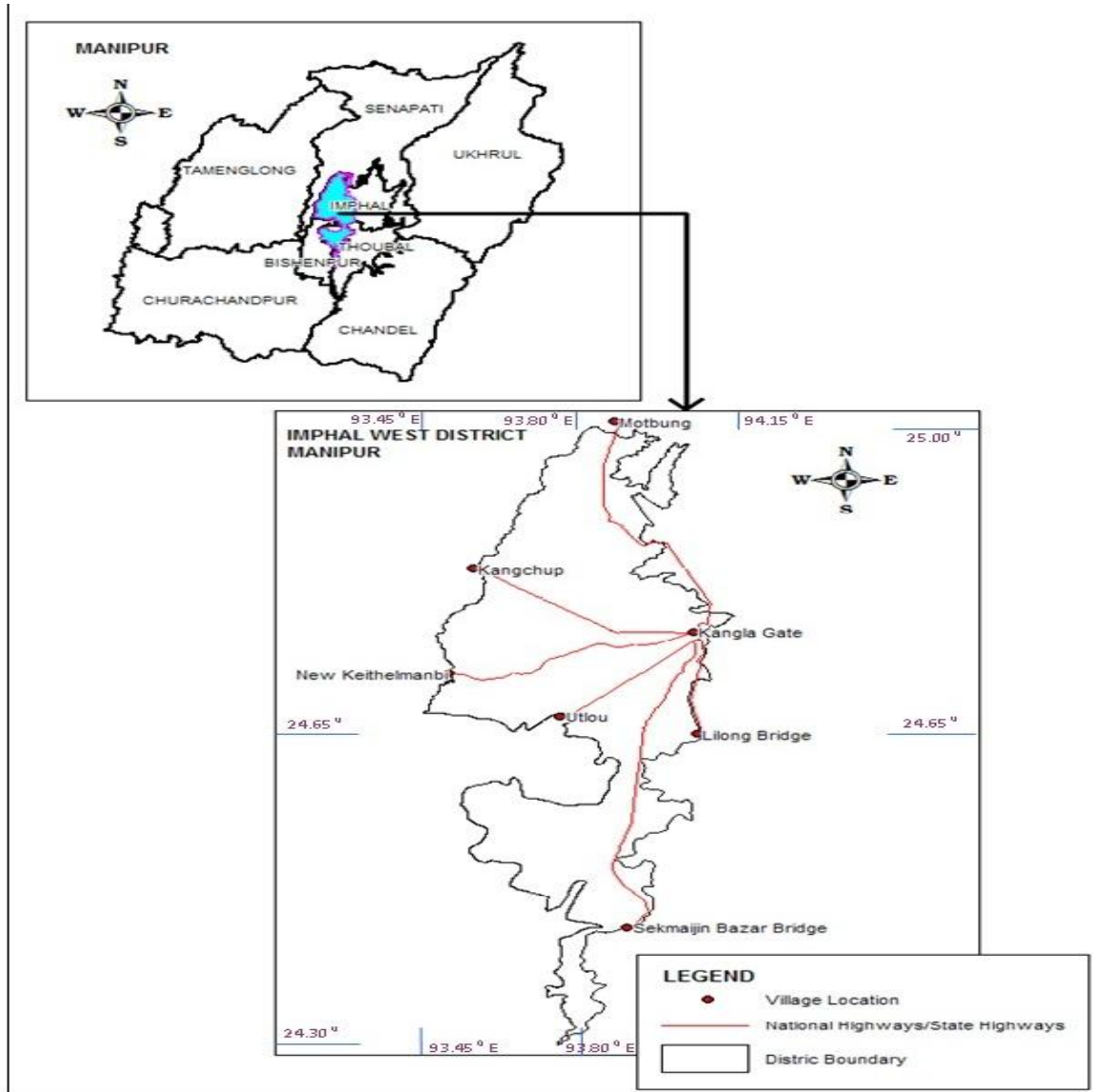


Fig. 1: Location Map of Imphal West District in Manipur

RESULTS AND DISCUSSION

Rice productivity along the highways

Collective responses from the farmers as well as observation showed that rice productivity along the adjoining fields and farther ones were markedly different. Between the years 2009 and 2010, annual paddy production were found to be differed by an average of 800 to 1050 kg per hectare of the aforementioned cultivation areas (Table 1). This pattern was apparently preceded by delayed flowering of the plants nearer to roadside by about a week as compared to those grown farther from the road.

Rice production and roadside trees

The question of reduced productivity in rice has been an intriguing issue among the farmers. It pertains to a general notion that the shade casts by the roadside trees affect the normal physiological functioning of the plants. Further it is assumed that under optimum growing conditions provided, shade from the trees restrict the photosynthetic activities as well as the flowering of the plants in time. However, a critical examination of the problem clearly indicates that shading alone cannot explain the pattern of reduced productivity in the rice plants of the said areas.

Shade and photosynthesis

For many crops, quantity and quality of the available light is crucial for their productivity in addition to other normal growth conditions. Irrespective of the prevailing climatic condition, crops generally can photosynthesize efficiently if the optimum intensity of light between 460 nm and 700 nm wavelengths are available. This is because the absorption of light by photosynthetic apparatus and its subsequent utilization during the process is most efficacious. According to Salisbury and Ross (1986), plants native to open habitat receiving adequate sunlight can attain considerable adaptation level as compared to those native to shaded areas. Under such circumstances, many physiological modifications occur in the plant. But, still, there are genetic limits to this ability. It is commonly observed that plants whose leaves are shaded most of the time are much more likely to have less productivity than those with better exposure to the available sunlight

(Halfacre, 1979). In the shade, physiological activities of the plants are suppressed resulting into thinner and larger leaves with fewer cells, lower dry weight per unit area and lower rates of dark respiration. In the process of photosynthesis, Blackman's law of limiting factor is especially relevant and out of several factors responsible to maintain the pace, photosynthesis is governed by the slowest moving factor (Gangulee *et al.*, 1997). In addition, some amount of shade is beneficial to plant growth and development. Under lighter shade, production is usually higher (Rosenberg, 1974). This can be explained by the fact that under high light intensities, the chlorophyll undergoes photo-reduction which consequently lowers the rate of photosynthesis, a process known as "Solarization" thus making shade suitable for the physiological activities of such plants. This enables the plant to effectively photosynthesize under favourable microclimate of shade.

TABLE 1: Paddy production trends between areas nearer to road and areas away from road along the five highways studied in Imphal West District of Manipur.

S. No.	ROUTE	AVERAGE PRODUCTIVITY (kg/ha)		AVERAGE DIFFERENCE (Kg/ha)
		Area farther from road	Area nearer to road	
1	NH 39	3400	2600	800±400
2	NH 53	3200	2150	1050±525
3	NH 150	3100	2300	800±400
4	IK ROAD	3800	2650	1150±575
5	IM ROAD	3300	2400	900±450

Photoperiodism and productivity

Photoperiodism is one of the most important aspects of plant growth and development. Length of the day and night modulate the important developmental stages of plants. In photoperiodism, the best known impacts are observed with the flowering of the plant. Generally, flowering is governed by uninterrupted light and dark periods to which the plants are exposed depending upon the photoperiodic response of that plant in question.

Rice, being a short day plant, the duration of continuous dark period is very much crucial to the plant productivity. In such plants, it is essential that they receive a critical uninterrupted dark period. It has been widely reported that even a single flash of light breaking the continuous dark period can alter the flowering behaviour of the plant implicating a reduced productivity both in quality and quantity (Pandey and Sinha, 1972; Vergara and Chang, 1985; Salisbury and Ross, 1986 and Gangulee *et al* 1997). According to experiments conducted at the International Rice Research Institute (IRRI), Manila, Philippines, flowering has been found to be prevented or delayed by interruption of dark period of light intensities varying from 1 lux to more than 200 lux. Stronger retardation was associated with higher light intensities. The experiments further observed that duration of interruption was equally crucial whereby flowering retardation were observed under exposure period ranging between a flash to as long as 15 minutes at 100 lux. Moreover, noticeable effect was found at distances as far as 270 m from the light source (Vergara and Chang, 1985).

As some of the most important routes of the district as well as the state of Manipur, the five highways remain utilized throughout the year including rice growing period. Consequently, the cultivation nearer to the road are exposed to varying amount of flashlights from the headlights of vehicles plying during the night. The reason, thus, for the reduced productivity pattern of rice can be inferred upon the phenomenon of photoperiodism.

CONCLUSION

The issue of reduction in rice productivity in the fields adjoining the highways in Imphal West District is not a concern of significant importance as a whole. However, in the long run, the productivity pattern symbolizes a deteriorating concern to those marginalized and small farmers who hold a major chunk of the farming community in the district. Moreover, photoperiodic effect does not discriminate other important crops too, which definitely bears the cause of concern in the food scenario of modern times. The work, thus, calls for detailed analysis and research covering other varieties of crops growing along the roads and highways so that development could be brought about in a more sustainable and productive manner.

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