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SHORT REPORTS

SOME CHARACTERISTICS OF PLANTS GROWING AT THE SALT-AFFECTED AREA IN NORTHEAST THAILAND

PONGSIRI PATCHARAPREECHA[a], NAYANA PUENGPAN[b], TERDSAK SUBHASARAM[c], AND HIDENORI WADAD[d]

[a] *Department of Soil Science, Faculty of Agriculture, Khon Kaen University, Khon Kaen 40002, Thailand.*

[b] *Department of Chemistry, Faculty of Science, Khon Kaen University,Khon Kaen 40002, Thailand.*

[c] *Department of Land Development, Region V, Khon Kaen 40000, Thailand.*

[d] *Agricultural Development Research Center in Northeast Thailand,Thailand.*

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ABSTRACT

*Year round observations of both native and exotic plants at an experimental field revealed their strategies to flourish and survive inthe salt affected area in Northeast Thailand where rainy season and dryseason alternate in a year and where impermeable layers (which arereduced in the rainy season) are present near the soil surface. Plants flourishing in the rainy season ("rainy season weeds") whichwere tolerant to strongly reductive state of the soil, were primarilyannual plants. These plants were considered to be r-strategists.*Plants flourishing in the dry season ("dry season weeds") which weretolerant to high salinity and drought, were primarily perennial plants. These were regards a K-strategists,** though some of them could adopteither strategies depending on the conditions.*

INTRODUCTION

Plant growth in salt affected areas in Northeast Thailand has caught the attention of several botanists[1-3] and agronomists.[4] The former have obtained a list of the native plants growing in the salt affected areas by surveying the plant species present in a certain periodin the year. The latter have cultivated various plants in the saline soil both in the green house and in the field to find the plants which were adaptable to the salt affected areas. The results of the two groups have seldom been integrated. This is probably due to differences in their interests. For integration of the results, some ecological knowledge of the plants growing in the salt affect areas is necessary.

* r-strategist: Organisms with many small offsprings, rapid growth andshort life span which are advantageous in unstable environments wherethe population density is low.

** K-strategist: Organisms with a few big offsprings, slow growth andlong life span which are advantageous in stable environments where thepopulation density is high.

We have observed growth of both native plants and exotic plants in the salt affected areas, primarily in an experimental farm established in Ban Phra Yun, Khon Kaen Province.[5-7] Our year round observations revealed some soil plant relationships in the salt affected areas are influenced by the presence of the impermeable layers. For instance,the dominant plant species in the rainy season and in the dry season are different. The former and the latter were tentatively classified as "rainy season weeds" and "dry season weeds".[6]

It was observed that in the rainy season, the water saturated impermeable layers at shallow depths retained some salt and were reduced.In the dry season, however, the rhizospheric soil including the impermeable layer became salty. The "rainy season weeds" should therefore be strongly tolerant to the reductive state of the soil and be weakly tolerant to salt, while the "dry season weeds" should be strongly tolerant to salinity and weakly tolerant to the reductive state of thesoil. Representative "rainy season weeds" and "dry season weeds" are *Fimbristylis millacca* Vahl and *Panicum repens* L., respectively.

MATERIALS AND METHODS

Field: The experimental field is located along Road No. 2062 in a southern suburb of Ban Phra Yun, Khon Kaen Province. The field is a segment of a gentle slope. Salt patches (as evidenced by denuded patches due mainly to the high salinity of the soil) became more prominent with decreasing height of the slope. In a wide salt patch near the upper boundary of the farm, various exotic plant species were cultivated in rectangular plots (1 x 2 m) for each plant species, beginning July 30, 1990. Before sowing the seeds, the plots were plowed to a depth of 15 cm and harrowed.

OBSERVATIONS

Above ground parts of both native weeds and cultivated exotic plants were observed for their occupancy and vigor year around. Thesoil and the plant roots were examined to clarify possible explanations of the observations.

RESULTS AND DISCUSSION

Most of the exotic plants quickly disappeared and were gradually replaced by native weeds, especially, *Panicum repens*.[8] The rate of replacement depended on the nature of the exotic plants, the nature of the native weeds and the soil condition. Only Rhodes grass, *Sesbania* spp., *S. rostrata* and *S. aculcata*, were still alive after one year.

The "rainy season weeds' which are principally annual plants, appeared at almost every favorable places in the rainy season and quickly died when the soil became dry.[8] These characteristics would be realized if there is a wide spreading of the seed and a quick germination of the seed when the conditions are favorable.

P. repens also spreads its numerous seeds over a wide area. It sseeds germinate and grow rapidly. However, the rate of germination and growth of this grass is less than those of the "rainy season weeds". Inaddition, *P. repens* has thickened terrestranean roots which can survive in the dry season and regrow the above ground part of the plant and can extend

runners into the neighboring places for expansion of their territories when the soil becomes moist following rain showers. A part ofthe terrestranean stem appears to survive even when most of the plant is killed in the reduced soil in the rainy season. Among the successful plants, Rhodes grass more or less monopolize their own plots. No Rhodes grass appeared outside of their plots (See Fig. 1). This and other information[7,9] suggest that if many seedlings of the Rhodes grass germinate and grow vigorously, native weeds cannot compete with the Rhodes grass once established in a plot.

This area monopolization is not seen in plots of the sesbania species. Here we see (Fig. 2) that these plots were invaded by native weeds to various degrees and that the growth of sesbanis species was not a good as expected. A possible reason might be that the growth of the sesbania species stops when the plants begin to flower (due to their photosensitive nature) at the end of the rainy season. This explanation is supported partly by the observation that almost no native plants invaded the plots in the first few months after the seeding when the seedlings of the sesbania were numerous and were vigorously growing.

Sesbania spp., a perennial sesbania, regenerated a few new stem in the dry season when most of the original above ground parts had already died. This could be the result of small rain showers happening in the dry season. In the next rainy season following the dry season, the surviving sesbania species, especially *S. rostrata* and *S. aculeata* expanded their territories outside their respective plots: a few plants of *S. rostrata* and *S. aculeata* succeeded in growing along a rill where the "rainy season weeds" also grew (Figs. 3 and 4). We examined the roots of the newly grown sesbania species and found that a part of their roots were white and soft (Fig. 5), which arecharacteristic morphology of sesbania roots growing in submerged soil. This was considered to give support to our earlier conjecture that the impermeable layer was reduced when it was saturated with water for long periods in the rainy season.[5,6] We also noticed that most of the root (including the tap root) extended horizontally over the impermeable layer (Fig. 6). This indicated that the roots of the sesbaniaspecies were not tough enough to penetrate through the hard subsurface horizons of the sandy soil. This is in accord with the observations of Patacharapreecha *et al.* (unpublished data).

After the start of a more or less continuous rain in the middle of 1991, we observed that the leaves of S. rostrata became yellow and somewhat wilted and that their roots appeared damaged. On the other hand, the leaves of *S. aculeata* remained green. Looking at the roots of the wilted *S. rostrata*, we found root knot nematodes. We suspect that the roots of *S. rostrata* were more sensitive to nematodes living in the salt affect area that those of *S. aculeata* and were damaged by the nematodes accordingly. Both sesbania species were spontaneously nodulated on the stems and/or roots. Dormant cells of azorhizobia must be present ineither the salt affected soil or in the seeds of the *Sesbania* species.

The following hypotheses were made on the bases of the above observations and on the information from previous studies[7]:

In the salt affected regions in Northeast Thailand, the "rainy season weeds" and the "dry season weeds" are r-strategists and K-strategists, respectively. Wide spread of seeds and quick germinationand growth at favorable places is a typical r-strategy of the annual"rainy

Fig. 1. Rhodes grass monopolized in their own plot.

Fig. 2. *Sesbania* species were invaded by native weeds.

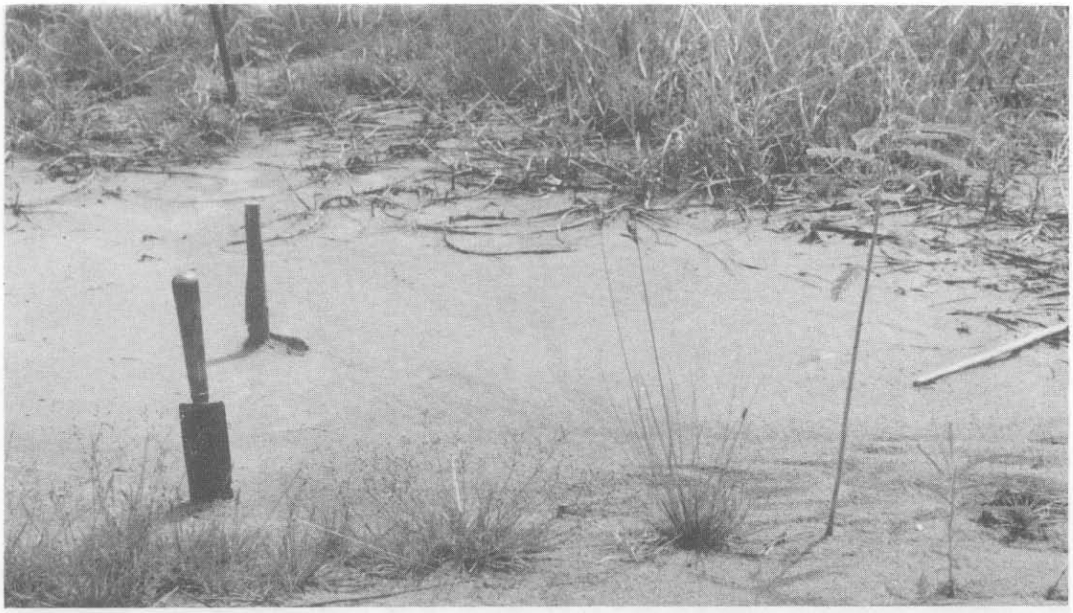

Fig. 3. The surviving *Sesbania* spp. especially *S. rostrata* and *S. aculeata* expanded their territories outside their plots.

Fig. 4. *S. rostrata* and *S. aculeata* succeeded to grow along the rill where the "rainy season weeds" grew also.

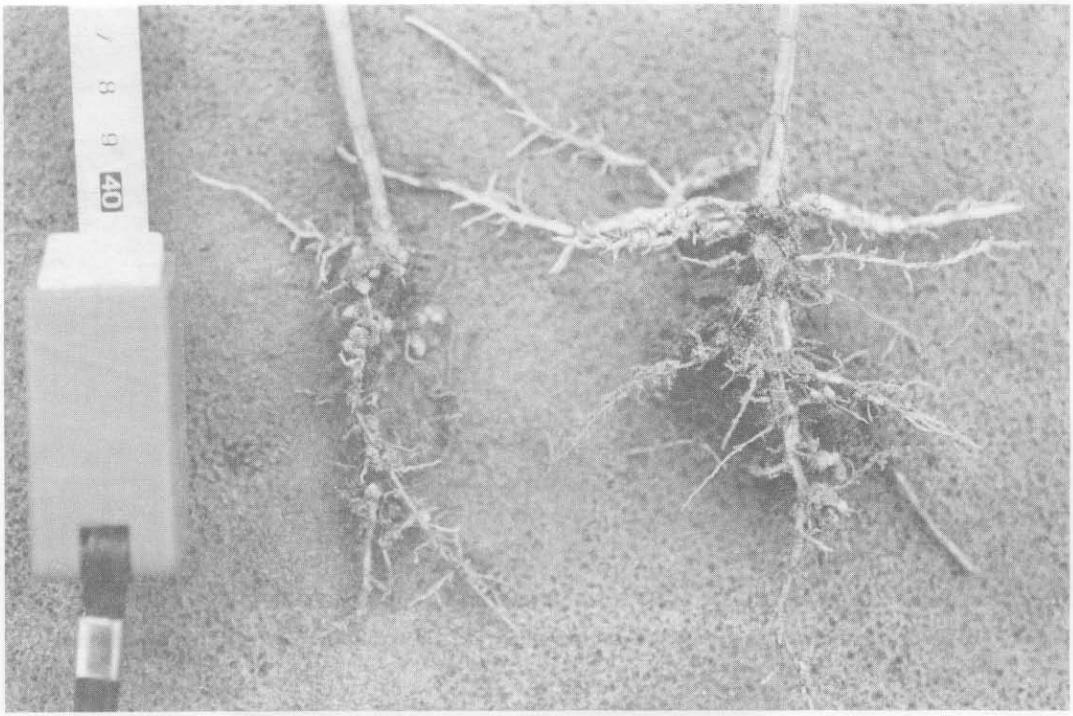

Fig. 5. Roots of newly grown *Sesbania* spp. were white and soft.

Fig. 6. *Most of the roots extended horizontally over the impermeable layer.*

season weeds" and the survival of the subterranean stems is atypical K-strategy of the perennial "dry season weeds". In this regard, some "dry season weeds" such as *P. repens* have dual strategies,though the *P. regens* are not typical r-strategists since their rates of germination and growth are less than those of the annual " rainy season weeds".

In the long run, the salt affect areas will be dominated by "dry season weeds" since these weeds will keep their territories and will always be searching for new places to colonize. Also the impermeable layer, which inhibits the colonization of the "dry season weeds" is gradually being destroyed, both naturally and artificially (by man).

Sesbania species have strategies inbetween the r-strategy and the K-strategy. The strategies of the annual sesbania species are akin to the r-strategist, while the perennial sesbania species are akin to the K-strategists.

Wild rice have been found to have similar strategy in Thailand[9]: Perennial wild rice and annual wild rise are dominant in the stable sites and unstable sites, respectively. This finding is consistent with the above hypothesis.

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บทคัดย่อ

จากการศึกษาวิจัยพืชทั้งชนิดที่ขึ้นเองตามธรรมชาติและสายพนัธุ์ที่คัดเลือกแล้วในหลายๆ รอบปี ในสภาพแวดล้อมที่เป็นดินเค็มในภาคตะวันออกเฉียงเหนือ ที่มีฤดูฝน และฤดูแล้งสลับกัน และมีชั้นดินที่ไม่ซาบซึมน้ำ (impermeable layer) และอยู่ในสภาพรีดิวซ์ในฤดูฝนอยู่ค่อนข้างใกล้ผิวดิน พบว่าพืชที่เจริญเติบโตได้ดีในฤดูฝนหรือวัชพืชฤดูฝนจะทนต่อสภาพรีดิวซ์ เป็นวัชพืชปีเดียว (annual) และเป็นกลุ่มพืชที่จัดไว้ใน "r-strategists" ในทางตรงกันข้ามพืชที่เจริญได้ดีในฤดูแล้งหรือวัชพืชฤดูแล้งจะปรับตัวและขึ้นได้ดีในฤดูแล้งที่ดินมีสภาพแห้งและเค็มจัด เป็นพืชที่มีอายุหลายปี (perennial) เป็นกลุ่มพืชที่จัดไว้ใน "K-strategists"