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ABBREVIATIONS AND SYMBOLS

A-a	A pair of alleles, a gene pair, a single-gene difference. A is the allele that increases and a decreases the expression of the character.
d	The departure of one of a pair of corresponding homozygotes from their mid-point or mid-parent (m). It is positive for the homozygote carrying the increasing allele and negative for that carrying the decreasing allele. The relevant gene pair may be denoted by a subscript: thus AA departs from m by d_a and aa departs from m by $-d_a$
D	$= S(d^2)$ The genetical additive component of variation
df	Degrees of freedom.
E_W	The non-heritable component of variation ascribable to differences expressed within a family.
F	$= S(dh)$
H	$= S(h_2)$ The dominance component of variation.
$\sqrt{(H/D)}$	Dominance ratio
h^2	Heritability
h^2_b, h^2_n	Broad and narrow sense heritability.
P	Probability, in relation to test of significance
Si	Silicon
s^2	Sample variance
s^2_{P1}, etc.	Variance of P_1, etc.
V	A variance, the relevance of which is indicated by a subscript. Thus V_{P1} is the variance of P_1 (the larger parent), V_{F1} that of F_1, V_{F2} the of F_2 etc.
$\chi^2_{[df]}$	Chi-square

INTRODUCTION

Upland rice is grown in Asia, Africa and Latin America on nearly 19 million hectares, making up 12% of the total worldwide production of rice (Seebold *et al.*, 2000). It is commonly grown higher in the toposequences on aerobic soils, sometimes on sloping lands. Three predominant agroclimatic zones with different risks of drought and sets of additional constraints are recognized, which differ geographically and climatically: dry plateaus of South Asia with permanent integrated system, hilly subhumid areas of mainland Southeast Asia with shifting cultivation and slash-and-burn, and equatorial humid areas with perennials in Indonesia, southern Vietnam and southern Philippines (Wade, 1999).

Shifting cultivation covers some 1 million hectares in extreme northeast India (Assam, Tripura, Manipur, Nagaland, Aruchnal Pradesh), north Myanmar, north Thailand, north Vietnam, Lao PDR and South China, which corresponds to the hilly semi-humid sub-ecosystem. But some slash-and-burn is also found in Indonesia (10% of the upland rice area in Sumatra, West Kalimantan and Sulawesi) under equatorial conditions. In the hilly semi-humid sub-ecosystem, the main constraints are weeds and poor soil fertility. Drought sometimes is an intermittent problem. Blast can be important locally or annually but is not a general problem. Average yield varies widely; from 3.0 to 4.5 t ha^{-1} locally observed for a first year of slash-and-burn and down to less than 1 t ha^{-1} for harsher conditions (Courtois and Lafitte, 1999).

Drought is defined as a sustained period of time without significant rainfall (Swindale and Bidinger, 1981). This is one of the major factors limiting upland rice yield and occurs frequently in rainfed uplands of north Thailand, which correspond to the hilly semi-humid sub-ecosystem. In the hilly semi-humid sub-ecosystem, rainfall ranges from 1,200 to 3,000 mm. This is enough to sustain the needs of the upland rice, but the distribution can be erratic, with risk of moderate drought spell (2-3 weeks) during the tillering stage of cropping season. It is the main cause of yield instability in upland rice (Courtois and Lafitte, 1999) which is directly proportional to the amount of water transpired and nutrient uptake (Alam, 1999; Shama and Singh, 1999); so the high tolerance of upland rice to drought has been the subject of studies of many plant physiologists and breeders.

Study on plant physiology, silicon is an essential element for rice (Takahashi, 1995) and has also been implicated in drought resistance (Lux *et al*., 2002) because most of the silicon in rice is deposited in the outer walls of the epidermal cells of the leaves. The epidermal cell walls are impregnated with a layer of silicon and become an effective barrier against water loss by cuticular transpiration (Balasta *et al*., 1989). These findings demonstrate that by increasing silicon content of rice plant, it may be possible to reduce their internal water stress. Besides drought tolerance, silicon content in some rice genotypes has been correlated with disease and/or insect resistance (Datnoff *et al*., 1991, 1992) and shown to be an indicator of adequacy of plant available silicon for achieving high acceptable grain yield (Snyder *et al*., 1986); therefore, it should be possible to breed upland rice for drought condition by selecting high silicon uptake genotypes. However, it is essential to understand the mode of inheritance for this efficient breeding program because the information in its turn can be used to make important decisions about the strategies and tactics of upland rice breeding. At present, there is no report about the inheritance of silicon uptake under drought condition. Thus, studying about genetics analysis of silicon uptake in upland rice under drought condition is essential to understand for developing and selecting drought resistance genotypes. The work reported in this thesis is based on the following three hypotheses:

1. The upland rice genotypes will differ in their silicon uptake abilities under drought condition.

2. Under drought condition, there is a relationship between the leaf silicon content and drought resistance in rice genotypes.

3. Inheritance of silicon uptake, yield and yield component traits in upland rice which is grown under drought condition is complex and controlled by many genes.