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IN SITU CONSERVATION OF RICE LANDRACES AMONG THE BADUY OF WEST JAVA

JOHAN ISKANDAR
Department of Biology and Institute of Ecology
Padjadjaran University
Bandung, Indonesia

AND

ROY ELLEN
Department of Anthropology
University of Kent at Canterbury
Canterbury, Kent CT2 7NS, United Kingdom

ABSTRACT.– A large number of landraces of rice have disappeared from irrigated fields in lowland Java since the adoption of high yielding varieties (HYVs) promoted by the Indonesian government. However, such genetic erosion has not taken place amongst the upland Baduy population. This is because maintenance of a traditional system of swidden (forest fallow) farming is considered to be both a religious obligation and a form of cultural identity. Baduy dry rice landraces are used mainly for performing rituals and in the feasts accompanying them. They cannot be sold, though in order to fulfil daily food requirements, various crops (fruit, vegetables, palm sugar) are traded for hulled lowland rice. The objective of this article is to document the way in which cultural practices serve to maintain diversity in traditional rice landraces.

Keywords: in situ conservation; rice varieties; swiddening; West Java

RÉSUMÉ.– Avec l'introduction des variétés a haut rendement encouragée par le gouvernment indonésien, un grand nombre de variétés de riz ont disparu des rizières irriguées des basses terres de Java. Cette érosion génétique n'a pas affecté les Baduy qui vivent dans les hautes terres de l'île. Cela s'explique par le fait que maintenir le système traditionnel d'agriculture sur brûlis est considéré a la fois comme une obligation religieuse et comme une forme d'identité culturelle. Les variétés baduy cultivées en rizière sèche sont conservées pour un usage essentiellement cérémoniel et rituel. Ces variétés ne peuvent être vendues, et d'autres produits (fruits, légumes, ou sucre de palme) sont commercialisés pour couvrir les nécéssités de base, en particulier l'achat de riz blanc provenant des basses terres. Cet article documente les pratiques culturelles qui ont permis de maintenir la diversité des variétés de riz traditionellement cultivées par les Baduy.

Mots clés: conservation in situ; culture sur brûlis; Java occidental

RESUMEN.– Un gran número de especies ancestrales de cultivos de arroz ha desaparecido de los campos irrigados en las tierras cálidas de Java, desde la adopción de variedades de alta productividad promovidas por el gobierno Indonesio. Sinembargo, tal erosión genética no ha tenido lugar entre la población

Baduy de climas frios. Esto se debe al mantenimiento de sistemas tradicionales en los que se quema el rastrojo o la maleza (monte de barbecho) y en los que la labranza es considerada tanto un deber religioso como una forma de identidad cultural. Las ancestrales especies de cultivos de arroz seco de Baduy, son usadas principalmente para representar ceremonias y en las fiestas que las acompañan. Estas no pueden venderse; para el sustento diario se almacenan varios cultivos (frutas, verduras, azucar de palma), los cuales son intercambiados por arroz trillado de clima cálido. El objetivo de este trabajo de investigación es documentar la forma en la cual las prácticas culturales sirven para mantener la diversidad en variedades tradicionales de cultivos de arroz.

Palabras clave: Conservación en el lugar de origen o in situ; tipos ancestrales de arroz, quema de rastrojo; Java Occidental.

INTRODUCTION

Over many centuries peasant farmers in Java have developed an irrigated system of rice cultivation (***sawah***) which involved the maintenance and creation of many distinctive varieties (Gelpke [1874] 1986, Geertz 1963, Terra 1958). Different varieties were planted in different plots to maintain the homogeneity of the germplasm, and under such a regime varieties were actively selected which reflected the special needs of various local environments: water availability and tolerance, soil type and nutrients, exposure to sunlight, and so on. Moreover, every stage of the rice cycle involved ritual focusing on veneration of the rice goddess and, therefore, with ensuring crop productivity (Mustapa [1913] 1985, pp. 83-84; Gelpke [1874] 1986, Soeganda 1982: 150-166). The rice products were mainly used to fulfil subsistence needs, although there is a long historical tradition of rice export to other parts of the Indonesian archipelago. Thus, phenotypic diversity of rice was firmly rooted in locality and in the religious regulation of the farming cycle.

The increasing use of Green Revolution technology in Indonesia since the late nineteen sixties, and in particular the introduction of High Yielding Varieties (HYVs) of rice, has led to extensive genetic erosion of traditional varieties here and in other parts of southeast Asia (Brush 1991: 158-9), as well as significant ecological, social, economic and cultural changes in farming practices (e.g. Nørlund, Cederroth and Gerdin 1986, Palmer 1976). In some places the planting of native varieties has been actually forbidden (e.g. Lansing 1991: 113); though the goal of high productivity has, above all else, been responsible for the exclusion of local varieties. However, among the Baduy, an enclave population practicing swidden or forest-fallow cultivation in the highlands of West Java, many old dry (upland, or hill) varieties survive through the requirements of traditional religious practice, and through the active rejection of the accouterments of the Green Revolution. This is especially evident in rituals connected with planting and harvesting practices, and with storage. Indeed, the seed of some varieties may be stored for between 50 and 90 years without apparent deterioration. What is additionally remarkable is that the effective conservation of phenotypic diversity is possible in an economic context where most rice consumed as food is obtained through the market from

lowland wet rice producers, and consists mainly of new HYV varieties which elsewhere are displacing local varieties. Lowland rice is exchanged for aren-sugar (*Arenga pinnata*) and other products. Thus, daily consumption relies on new varieties, while old varieties are produced and maintained through the religious obligation to sustain a traditional swidden system.

In this paper we wish to demonstrate how Baduy cultural practices maintain phenotypic diversity in rice, a connection which is still poorly understood for many domesticates (Brush 1992: 162). However, we do not automatically assume that phenotypic diversity is necessarily a good measure of genetic diversity, and acknowledge that varietal diversity calculated from local nomenclature may exaggerate the extent of genetic diversity actually present. We argue that members of the Baduy community have been successful in maintaining local rice varieties because their practices and underlying values are well adapted to the local ecological and socioeconomic upland environment and because, paradoxically, they have developed appropriate strategies enabling them to use the market to subsidise a traditional way of life. The data presented in this paper were obtained during field research conducted in the Baduy area by Iskandar in 1985, and between October 1995 and July 1996.

In situ conservation, the conservation of genetic resources in their pre-existing habitat, whether in natural or anthropogenic ecosystems, rather than under laboratory *ex situ* conditions, has attracted much attention in recent years. This is also the case - more specifically - for *folk* in situ conservation, that is effective conservation realised through farmer knowledge and experience which can be characterised as 'indigenous', 'local', or 'traditional', rather than that channelled through outside experts (Altieri and Merrick 1987, Brush 1991). Recent ethnobotanical research, for example, has shown that traditional farming methods often retain cultivars which under intensive and, especially, agro-industrial conditions have disappeared. Such cultivars have been selected on the basis of their suitability for local conditions (Brush 1986: 153), and for this reason confer many local advantages: ecological, economic and cultural. Moreover, farmers using traditional techniques have been shown to value diversity in its own right (Boster 1984, Shigeta 1996). We use the word *landrace* here (following Shigeta 1996: 235; see also Brush 1991: 154-5), to distinguish Baduy categories for sub-divisions of ancestral crop species from 'varieties' in the conventional Western taxonomic sense. Thus, in this context a landrace is a local category for grouping cultivated rice plants according to common characteristics reflected in specific vernacular names. Landraces represent locally distinguished types of germplasm developed by farmers, in contrast to 'varieties', which are usually the products of institutional breeding.

BADUY RICE CULTIVATION

The Baduy are a distinctive population of (in 1994-95) about 6440 individuals living in an upland area of some 5100 ha in Kanekes desa, sub-district of Leuwidamar, district of Lebak, residency of Banten, West Java (Figure1). They can be divided into two groups: about 502 'Inner Baduy' (Baduy Dalam, Urang Tangtu, Urang Girang, Kaum Daleum) and 5938 'Outer Baduy' (Baduy Luar, Urang

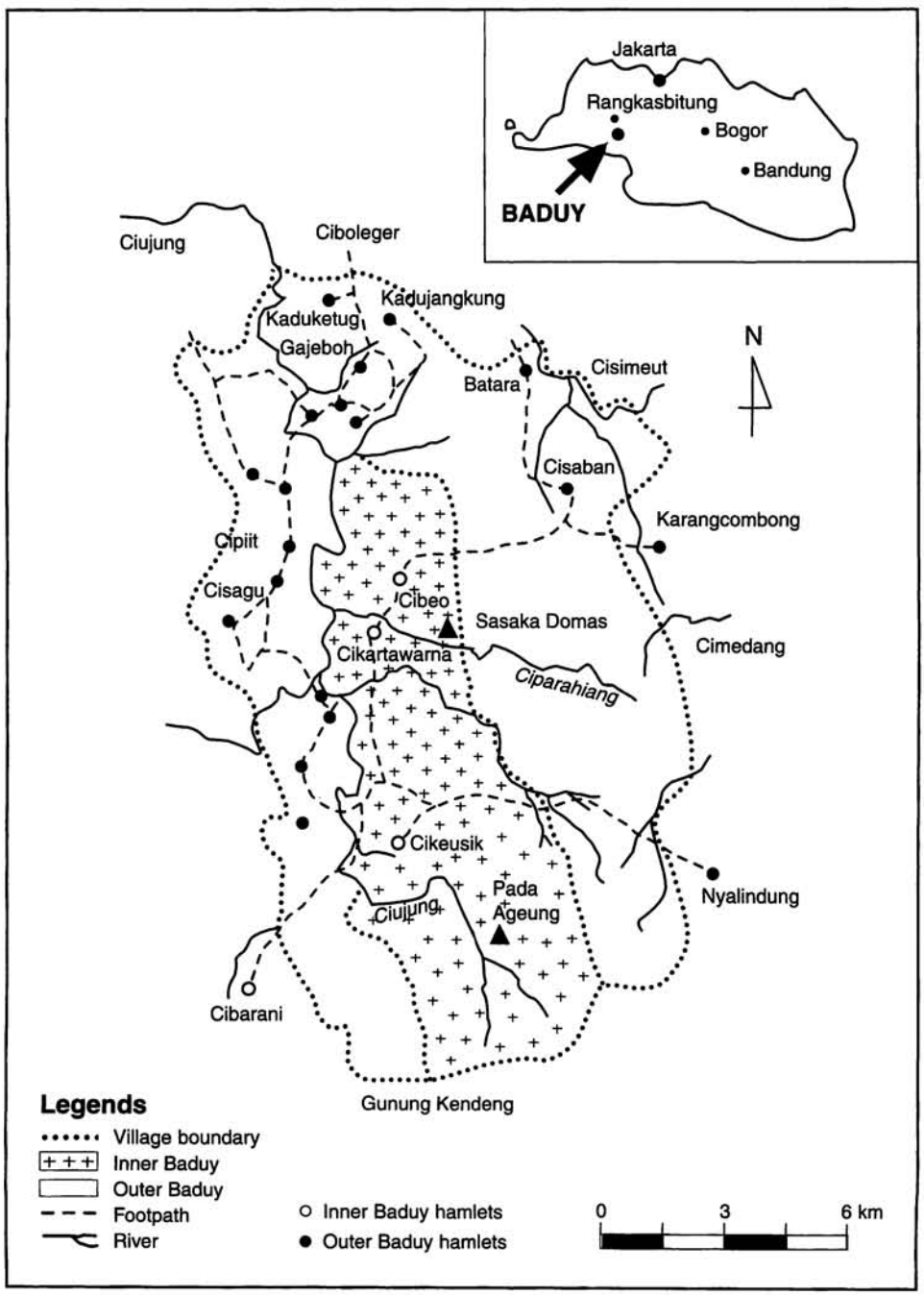

FIGURE 1.– The Baduy area of West Java

Panamping). Inner Baduy live in the hamlets of Cibeo, Cikartawarna, and Cikeusik, and in 1994 constituted about one eighth of the total population. Outer Baduy have a total population of about 5900, and inhabit some 44 hamlets located to the north, west and east of Inner Baduy. Surrounding these concentric areas is a buffer zone which contains both Baduy and non-Baduy, the Dangka, which has a number of crucial properties, not least of which is the ecological and cultural protection of the Baduy area proper.

Though the Baduy are ethnic Sundanese (West Javanese), their social organisation, religion and agricultural system differ from that of surrounding muslims, focussing instead on - and being unified through - ancestral customary law (***pikukuh***). Baduy traditional swidden farming is in many ways a remnant of a more widespread form of agriculture practised by the Sundanese, particularly in pre-islamic times. Swidden cultivation is so central to Baduy life and identity that anyone who does not practice it is no longer considered to be Baduy.

Of the various crops planted in a Baduy swidden field (*huma*) (Figure 2), the most important is rice (***pare*** = *Oryza sativa* japonica group1; padi, in Indonesian). Swidden rice is thus ***pare huma*** (unhusked) or ***beas huma*** (pounded and husked; beras, in Indonesian). Rice was commonly called Nyi Sri or Kersa Nyai ('the wish of Nyai') by ancient Sundanese, while rice cultivation was punctuated from beginning to end with various rituals (Mustapa 1985 (1913): 89; Soeganda 1982: 157; Locher-Scholten 1987: 83). Similar beliefs and practises are still found in Baduy. Swidden rice is considered sacred, a status expressed through veneration of its creator, the rice goddess, Nyi Sri Pohaci or Pohaci Sanghiyang Asri (Soeganda 1982: 170-72). Swidden rice and Pohaci Sanghyang Asri are, thus, aspects of a single reality, and both command respect (Danasasmita and Djatisunda 1986:78). It is for this reason that the cultivation of swidden rice is regarded as an obligation to the ancestors, and why it is prohibited to sell, gift or exchange rice landraces to non-Baduy.

Since swidden rice is sacred, and cannot be exchanged with non-Baduy, it is instead consumed mainly during the actual process of cultivating rice and on ritual occasions. In contrast, rice for ordinary consumption (which, in turn, may not be used in ritual) is acquired by trading non rice crops, such as banana (*Musa paradisiaca*), locus bean or petai (*Parkia speciosa*), durian (*Durio zibethinus*), rinu (*Piper rindu*), and palm sugar (*Arenga pinnata*), the last of which is produced by Outer Baduy only. These are harvested from swiddens (***huma***), protected anthropogenic forest surrounding hamlets (***dukuh lembur***), fallowed secondary forest (***reuma***), and protected forest (***leuweung kolot***). In addition, cash is acquired, particularly by Outer Baduy, by selling handicrafts and labour to neighbouring non-Baduy areas. Swidden cultivation of rice has for a long time been combined with the growing of fruit trees (Terra 1958: 160-161).

The six main stages of the swidden cycle, the work of which is articulated through ritual in ways which are known more widely from island southeast Asia (see e.g. Jensen 1974; Sutlive 1978; Visser 1989), and which are accompanied by the consumption of swidden rice include: (a) cutting underbrush (***nyacar***); (b) felling and pruning (***nuar*** and ***nutuh***); (c) burning (***ngahuru***), reburning debris (***ngaduruk***), and weeding under piles of debris (***nyasap***); (d) planting rice (***ngaseuk pare***); (e) first and second weeding (***ngored***); and (f) harvesting rice (***dibuat*** or ***panen pare***).

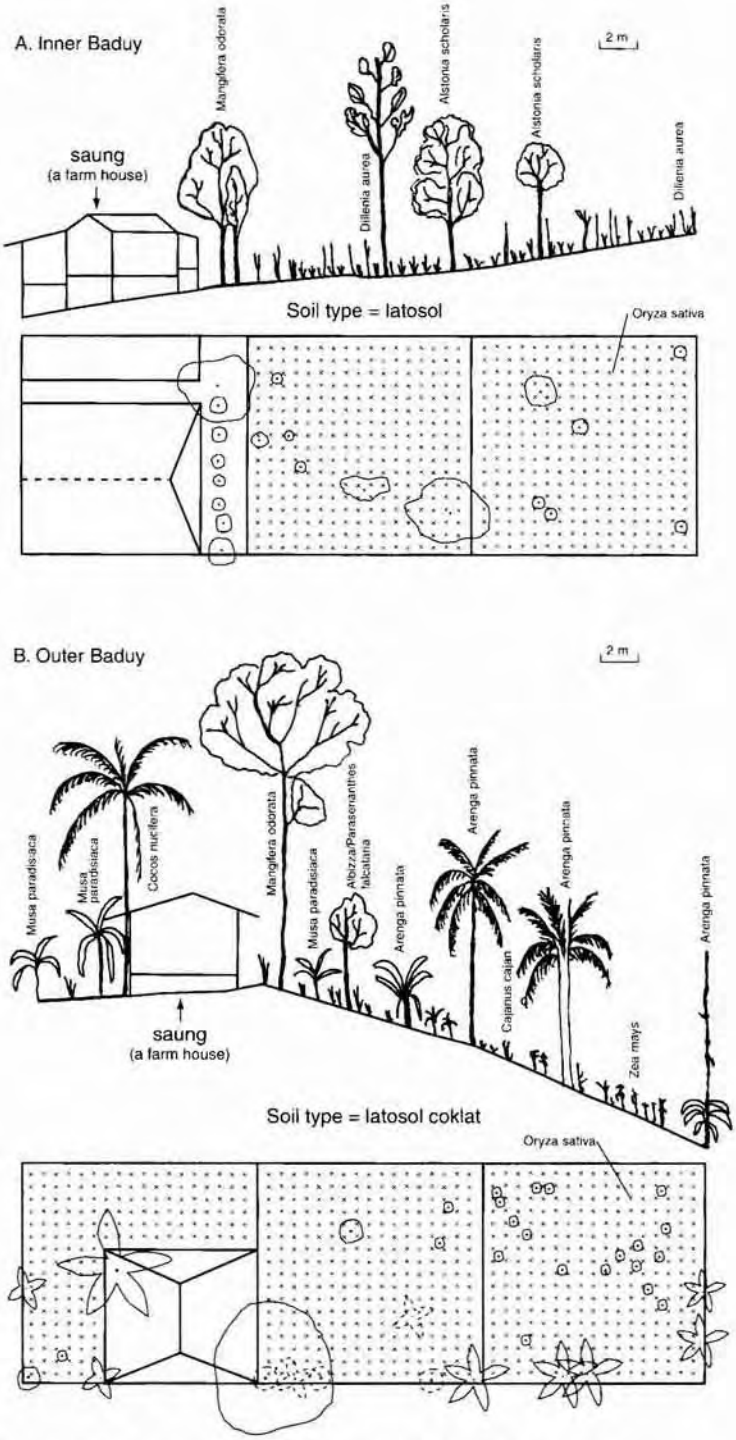

FIGURE 2.– Vegetation structure of a typical swidden plot (***huma***)

In addition, swidden rice is needed to perform various rituals in the hamlets whether these be conducted in each household (such as the *nganyaran* ritual, held after storing rice), or whether conducted communally, such as planting rice in sacred swidden plots, *huma serang*.

Swidden cultivation among Inner and Outer Baduy follows basically the same pattern. Six kinds of swidden are recognised, depending on ownership:

(1) *huma serang*, sacred swiddens belonging to the community, located in a special place to the south of each Inner Baduy hamlet, and never overlapping with other swidden plots. These are managed by *girang seurat* religious officials, but some tasks (such as cutting back bush and planting rice) are undertaken by the whole community;

(2) *huma puun*, swiddens belonging to and managed by the families of religious leaders (*puun*) located to the south of each Inner Baduy hamlet;

(3) *huma girang seurat*, swiddens belonging to and managed by families of the religious officials who assist the *puun* (*girang seurat*), located in a special place attached to the *huma serang*;

(4) *huma tangtu*, swiddens belonging to each Inner Baduy household, located outside the area of *huma* types 1-3, mostly to the north of each hamlet. Obtained through ancestral felling of mature forest, these swiddens (and particularly the perennial cultigens which they contain) are owned permanently and inherited. *Huma tangtu* in fallow may be loaned to other families.

(5) *huma jaro dangka* or *huma tuladan*, swiddens belonging to and managed by assistants of *puun* religious leaders (*jaro dangka*) living in the *dangka* area. These are considered less sacred than *huma serang*, and are used as a model swidden in Outer Baduy. Some activities, particularly planting rice, involve cooperation between Outer Baduy and performance of collective ritual; and

(6) *huma panamping*, swiddens belonging to Outer Baduy households, obtained on loan and through inheritance or purchase from other Outer Baduy, or through purchase, rent, sharecropping or exchange for labour from neighbouring non-Baduy.

The most important factor determining the first month of the Baduy calendar is the harvesting time of the *huma serang*. *Huma tangtu* and *huma panamping* are collectively termed *huma masyarakat* (community swiddens) as they are not directly controlled by religious leaders. Thus, work on the *huma masyarakat* is always preceded by work on the *huma serang*. To perform the rituals at the beginning of the farming year new rice from the *huma serang* must be used.

BADUY KNOWLEDGE AND MANAGEMENT OF RICE DIVERSITY

Baduy have developed a complex knowledge relating to the creation and maintenance of rice diversity. This involves folk identification, selection, sowing, protection, harvesting, and storage.

On the basis of a field survey conducted by Iskandar, 89 different named landraces have been identified from Inner and Outer Baduy combined (Table 1), all medium to tall (130-150 cm) traditional dry cultivars1. Although some landraces predominate and others are grown by only a few households, knowledge of all the different landraces is widely shared and evenly distributed through the entire

TABLE 1.– Baduy rice landraces, recorded by Iskander between 1995-97

Folk Name	Glutinous(G) or Non Glutinous(NG)	Hairy(H) or Non Hairy Seed(NH)	Seed Colour: White(W), Red (R) and Black(B)	Rate of maturation: early(EM), normal(NM)	Notes
1. pare alean	NG	H	W	NM	
2. pare ambu ganti	NG	H	W	NM	ambu = mother; ganti = change
3. pare anjeni	NG	H	W	NM	
4. pare areuy	NG	NH	W	NM	areuy = liana
5. pare baduyut	NG	H	W	NM	
6. pare balogor	NG	NH	W	NM	
7. pare bangban	NG	NH	R	NM	bangban = k.o. tree (*Donax* sp.?)
8. pare banter	NG	H	W	NM	hairs are black
9. pare baur	NG	H	W	NM	
10. pare batu	NG	NH	W	NM	batu = stone
11. pare bayur	NG	NH	W	NM	
12. pare bentik	NG	NH	W	NM	bentik = curled
13. pare beunteur	NG	NH	W	NM	k.o. freshwater fish (*Puntius* ?sp)
14. pare beureum tiwu	NG	H	R	NM	beureu = red sugar cane (var. of Saccharum *officinarum*); hairs are black
15. pare biluk	NG	H	W	EM	
16. pare bologor	NG	NH	W	NM	
17. pare bongkok	NG	NH	R	NM	
18. pare bunar	NG	NH	R	NM	
19. pare bubuay	NG	H	W	NM	
20. pare buntut manjangan	NG	H	W	NM	buntut manjangan = deer
21. pare buntut nyiruan	NG	H	W/R	NM	buntut nyiruan = tail of a big bee
22. pare cao	NG	NH	W	NM	
23. pare cere telong	NG	NH	R	NM	
24. pare cikur	NG	NH	W	NM	cikur = k.o. ginger (*Kaempferia* sp?)
25. pare cinggir	NG	NH	W	NM	
26. pare cokrom	NG	NH	W	NM	
27. pare gintung	NG	NH	R	NM	gintung = k.o. tree (*Beschafia* sp?)
28. pare guling	NG	NH	W	NM	
29. pare hawara bunar	NG	NH	W	EM	hawara = early maturing (rice)
30. pare hawara koas	NG	H	W	EM	koas = *Canavalia* sp
31. pare janah	NG	NH	W	NM	planted in huma serang
32. pare jawara	NG	H	W	NM	planted in huma serang
33. pare jeruk	NG	NH	W	NM	jeruk = orange (*Citrus* sp.)
34. pare karudin	NG	H	W	NM	
35. pare kapundung	NG	NH	R	NM	

Folk Name	Glutinous(G) or Non Glutinous(NG)	Hairy(H) or Non Hairy Seed(NH)	Seed Colour: White(W), Red (R) and Black(B)	Rate of maturation: early(EM), normal(NM)	Notes
36. pare kembang ading	NG	NH	W	NM	kembang = flower ?
37. pare kembang kalapa	NG	NH	W	NM	kembang kalapa = flr of *Cocos nucifera*
38. pare ketan areuy	G	NH	R	NM	ketan = glutinous; areuy = liana
39. pare ketan	G	H	W	NM	beledug
40. pare (ketan) bodas	G	H	W	NM	bodas = white; = pare (ketan) huis = grey hairs (syn.); planted in huma serang
41. pare ketan bulu kuda	G	H	W	NM	bulu kuda = horse hair
42. pare ketan gadog	G	NH	W	NM	
43. pare ketan hideung	G	NH	B	NM	hideung = black; = pare peuceuk = black (syn., partic. Inner Baduy; planted in huma serang
44. pare ketan kasumba	G	NH	R	NM	early maturing; blackish red grain; kasumba = *Bixa orellana*
45. pare ketan keuyeup	G	NH	R	NM	keuyeup = crab
46. pare ketan kidang	G	H	W	NM	kidang = the constellation of Orion's belt
47. pare ketan jalupang	G	H	W	EM	early maturing
48. pare ketan langgasari	G	NH	W	NM	langgasari = name of epic sung narrative; sacred; = pare indung?
49. pare ketan meloy	G	H	W	NM	
50. pare ketan nangka	G	H	W	NM	nangka = jackfruit; *Artocarpus* heterophyllus
51. pare ketan putri	G	NH	R	EM	putri = princess or daughter; planted in huma serang
52. pare ketan ruyung	G	NH	R	NM	
53. pare ketan siang	G	NH	R	NM	siang = day, bright; syn. = pare siang, pare beureum (partic. Inner Baduy); sacred, planted in huma serang
54. pare kiara	NG	H	W	NM	kiara = k.o. tree (*Ficus*)
55. pare kokak	NG	NH	W	NM	
56. pare kolelet	NG	H	W	NM	

Folk Name	Glutinous(G) or Non Glutinous(NG)	Hairy(H) or Non Hairy Seed(NH)	Seed Colour: White(W), Red (R) and Black(B)	Rate of maturation: early(EM), normal(NM)	Notes
57. pare koneng	NG	NH	W	NM	koneng = yellow, tumeric (*Curcuma domestica*); sacred
58. pare konyal	NG	NH	R	NM	konyal=fr. of *Antidesma* sp.
59. pare leungsir	NG	NH	W	NM	
60. pare limar	NG	NH	R	NM	
61. pare lopang	NG	NH	R	NM	
62. pare malati	NG	H	W	NM	malati = jasmine flr. (*Jasminum* sp.)
63. pare marukan	NG	NH	R	NM	
64. pare menteng	NG	NH	W	NM	menteng = fr. of *Baccaurea*
65. pare menyan	NG	H	W	NM	menyan = incense derived from benzoin gum, *Styrox* spp.; hairs are black
66. pare nagayanti	NG	H	W	NM	
67. pare nangsi	NG	NH	W	NM	nangsi = k.o. tree (*Villebrunia* sp.)
68. pare ninggul	NG	H	W	NM	hairs are black
69. pare pendok	NG	NH	W	NM	leger = non-hairy (leger) (rice)
70. pare peuteuy	NG	NH	W	NM	peuteuy = *Parkia* sp.
71. pare racik	NG	H	W	NM	hairs are black
72. pare reumay	NG	NH	W	NM	
73. pare rumbay	NG	NH	W	NM	
74. pare sabeulah	NG	NH	W	NM	sabeulah = half
75. pare salak	NG	H	W	NM	salak = fr. of a k.o. palm (*Salacca zalacca*)
76. pare sampay	NG	H	R	NM	
77. pare sempur	NG	H	W	NM	sempur = *Dillenia* sp.
78. pare sereh	NG	H	W	EM	sereh = lemon grass (*Cymbopogon citratus*); early maturing
79. pare seungkeu	NG	H	W	NM	
80. pare seuti	NG	H	W	NM	
81. pare sikep kuning	NG	H	W	NM	kuning = yellow
82. pare singgul	NG	H	W	NM	
83. pare sintung	NG	NH	W	NM	flr. stalk of *Cocos nucifera*
84. pare tanggay	NG	NH	W	NM	
85. pare tanjung	NG	NH	W	NM	tanjung = flr. of *Mimusops*
86. pare tapos	NG	NH	W	NM	
87. pare tundun	NG	H	W	NM	tundun = fr. of rambutan (*Nephelium* spp.)
88. pare tunggul	NG	H	W	NM	tunggul = tree stump
89. pare wanti	NG	H	W	NM	

Key: ( ) = optional; flr. = flower; fr. = fruit

TABLE 2.– Diagnostic characteristics used in Baduy rice classification.

	Main Criteria	Vernacular/	English	Notes
1.	Glutinousness of cooked rice; waxy endosperm	pare ketan	Sticky rice	Cooked rice is sticky Regarded as superior for culinary purposes
		pare biasa	Non Sticky rice	Cooked rice non sticky
2.	Hairiness of unhusked rice	pare bulu	Hairy	Unhulled rice has hair of various lengths and colours
		pare leger	Non hairy	Unhulled rice does not have hair
3.	Colour of hulled rice	beas beureum	Red hulled rice	Hulled rice has red colour
		beas bodas	White hulled rice	Hulled rice has white colour
		beas hideung	Black hulled rice	Hulled rice has black colour
4.	Shape, size and colour of grain	pare sabeulah	Half-size grain rice	Small rice grain
		pare ketan kasumba		Violet coloured grain rice
5.	Distinctive panicle	pare ketan hideung	Blackish panicle	Rice has distinctive blackish panicle
6.	Maturity	pare hawara	Early maturing	Rice can be harvested in less than 6 months

population. These are classified by Baduy on the basis of stickiness of the cooked rice, hairiness of the unhusked rice, colour of the hulled rice, distinctiveness of the panicle, length of time taken to mature, and shape, size, and colour of the grains (Table 2).

These distinctions are reflected in the general terminology applied to different types. Thus, glutinous landraces are ***pare ketan*** and non glutinous ***pare biasa*** (= 'ordinary'), hairy seed types are ***pare bulu*** and non-hairy ***pare leger***; those landraces maturing early (that is in less than 6 months) are ***pare hawara***, and those maturing later ***pare leuir***, and those with a dark stalk are ***jarami hideung***, in contrast to those with ordinary stalks. Each of these binary distinctions is important for the Baduy in grouping landraces according to key characteristics. It is difficult, however, to rank them in a way which would generate a unitary taxonomy of levels and contrasting types.

Of the 89 names listed in table 1, 73 are semantic and morphosyntactic binomials, while 16 are trinomials or optional trinomials. In every case, the trinomials contain as their middle segment the term ***ketan*** (glutinous), indicating through contrast the existence of a semi-covert residual grouping comprising the remaining 73 binomials. This grouping is co-terminous with the category ***pare biasa*** ('ordinary rice', non-glutinous) in regular speech. However, despite the lexical encoding of glutinousness, the most salient characteristic for Baduy farmers appears to be hairiness. Colour is second to hairiness as a diagnostic characteristic, though refers specifically to the husked grains. Other classifications, according to rate of maturity for example, would appear to be secondary to, independent of,

and cut across, this basic morphological distinction. Such an arrangement might best be represented analytically as a multi-dimensional paradigm in which differences are ordered through simultaneous intersection (e.g. Kay 1966) rather than as a standard taxonomy of levels and contrast.

Thus, Baduy rice landraces are distinguished and labelled according to ecological, morphological and culinary factors. Let us consider some of these in further detail. For ease of subsequent reference individual named landraces are prefixed by the identification number provided in table 1 and do not appear in boldface (e.g. 7-pare bangban).

1. Ecological factors include maturation period. Early-ripening types are known as ***pare hawara*** (and include 30-pare hawara koas and 29-pare hawara bunar). They are mainly used to replace rice in particular plots which has failed to grow, in order to maximise use of space and productivity. These landraces are planted approximately one month after the main planting, although they can be harvested at the same time as other landraces.
2. Some rice landraces are classified on the basis of grain phenotype, including hairiness, size, and colour. Modern varieties are generally non-hairy, with short straw, early ripening, photoperiod insensitive, responsive to the application of nitrogen, requiring more water and good drainage, are more productive and less attractive from a culinary point of view. 40 (45 %) of the 89 Baduy landraces recorded are recognised for their hairiness or for being awned3 (***pare bulu***); the rest (55 %) are recognised as awnless (***pare leger***). Prior to the Green Revolution, both the awned and awnless varieties were common throughout the Javanese lowland, usually named ***pare bulu*** and ***pare gundil*** respectively. Taxonomically, like the Baduy landraces, they were also types of *javanica* (see note 1). As far as the Baduy are concerned, though, the distinction between hairy and non-hairy, or awned and awnless, encodes no particular aesthetic preference. However, awned rice varieties do confer more protection against grain-eating pests, such as birds, rats and wild pigs (Burkill 1935: 1598), as a result of the physical properties of the hairs .
3. The colour, length and form of grain hair can also be used to classify rice varieties. Thus, 74-pare sabeulah is half the size (***sabeulah***, meaning half); 44-pare ketan kasumba is violet, ***kasumba***; 65-pare menyan is a black type, ***menyan*** meaning incense; 21-pare buntut nyiruan has short hair like the tail of a large bee, ***buntut nyiruan***. The colour of ***beas*** or husked rice is also used as a means of distinguishing different landraces e.g. 43-pare ketan hideung, ***hideung*** meaning black, and 51-pare ketan putri, or a blackish-red colour. Of the remainder, about 70 landraces are white (***beas bodas***), and 15 'red' (***beas beureum***). This proportion reflects a culinary preference for white rice.
4. Straw and panicle colour is also used to identify rice landraces e.g. 43-pare ketan hideung, with blackish straw and panicle.
5. Finally, landraces are distinguished on the basis of whether the grain has a waxy endosperm or not, i.e. glutinousness (c.f. Sakamoto 1996). Glutinous landraces are generally considered superior for culinary purposes, the cooked rice having a pleasant smell and being sticky. They are predominantly used for making traditional cakes and are consumed in rituals and ceremonies. About 15 (19%) of the 89 Baduy landraces are glutinous (***pare ketan***).

Table 3 groups the 89 landraces recorded according to combinations of four characteristics: hairiness, glutinousness, rate of maturity and colour. 13 of the 24 combinations have no representatives. 63 percent is made up of two combinations only: H.NG.NM.W and NH.NG.NM.W. This reflects the equal preference for white hairy and white non-hairy landraces. Sacred rice landraces are drawn from seven combinations, and include representatives of each character listed. What is surprising about the overall pattern is the absence of early maturing landraces amongst each of the most popular combinations.

Selection.– Rice is largely a self-pollinating plant in which some degree of outcrossing may take place between adjacent areas planted with different varieties, or between planted varieties and wild or weedy rice. Potential outcrossing is about 0.1-1 per percent. Landraces may be genetically homogeneous, but more usually combine several more-or-less homozygous lines. Therefore, to obtain pure seed

TABLE 3.– 88 Baduy landraces grouped by combination of four main diagnostic characters.

	Character combination present				No. landraces	Percentage	Sacred landrace (including those planted in ***huma serang***)
1.	H	G	NM	W	6	7	1
2.	H	G	NM	R	0	0	
3.	H	G	NM	B	0	0	
4.	H	NG	NM	W	26	29	1
5.	H	NG	NM	R	1	1	
6.	H	NG	NM	B	0	0	
7.	NH	G	NM	W	2	2	1
8.	NH	G	NM	R	4	4	1
9.	NH	G	NM	B	1	1	1
10.	NH	NG	NM	W	30	34	2
11.	NH	NG	NM	R	12	13	
12.	NH	NG	NM	B	0	0	
13.	H	G	EM	W	2	2	
14.	H	G	EM	R	0	0	
15.	H	G	EM	B	0	0	
16.	H	NG	EM	W	3	3	
17.	H	NG	EM	R	0	0	
18.	H	NG	EM	B	0	0	
19.	NH	G	EM	W	0	0	
20.	NH	G	EM	R	1	1	1
21.	NH	G	EM	W	0	0	
22.	NH	NG	EM	W	1	1	
23.	NH	NG	EM	R	0	0	
24.	NH	NG	EM	B	0	0	
Totals					89	100	8

Key. H = hairy, NH = non-hairy, G = glutinous, NG = non-glutinous,
NM = normal rate of maturity, EM = early maturing, W = white, B = black, R = red.

for planting the following year, rice seed must be properly selected. Baduy selection (***dipasing***) is usually undertaken during harvesting (see also discussion of harvesting below). Homogeneous and good quality (***beuneur***) bundles of panicles from different varieties (***huasan***) are selected and marked using special bamboo string. This is usually based on phenotypic appearance satisfying the characteristics of the particular landrace and on the presence of healthy and productive traits. It is the work of women assisted by their husbands. Before being carried to the settlements, these bundles are hung on a bamboo pole (***lantayan***) covered with a thatch of sago palm leaves (*Metroxylon sagu*) placed near the swidden shelter (Figure 5). Although different bundles come from different landraces they are not confused because of their distinctive marking.

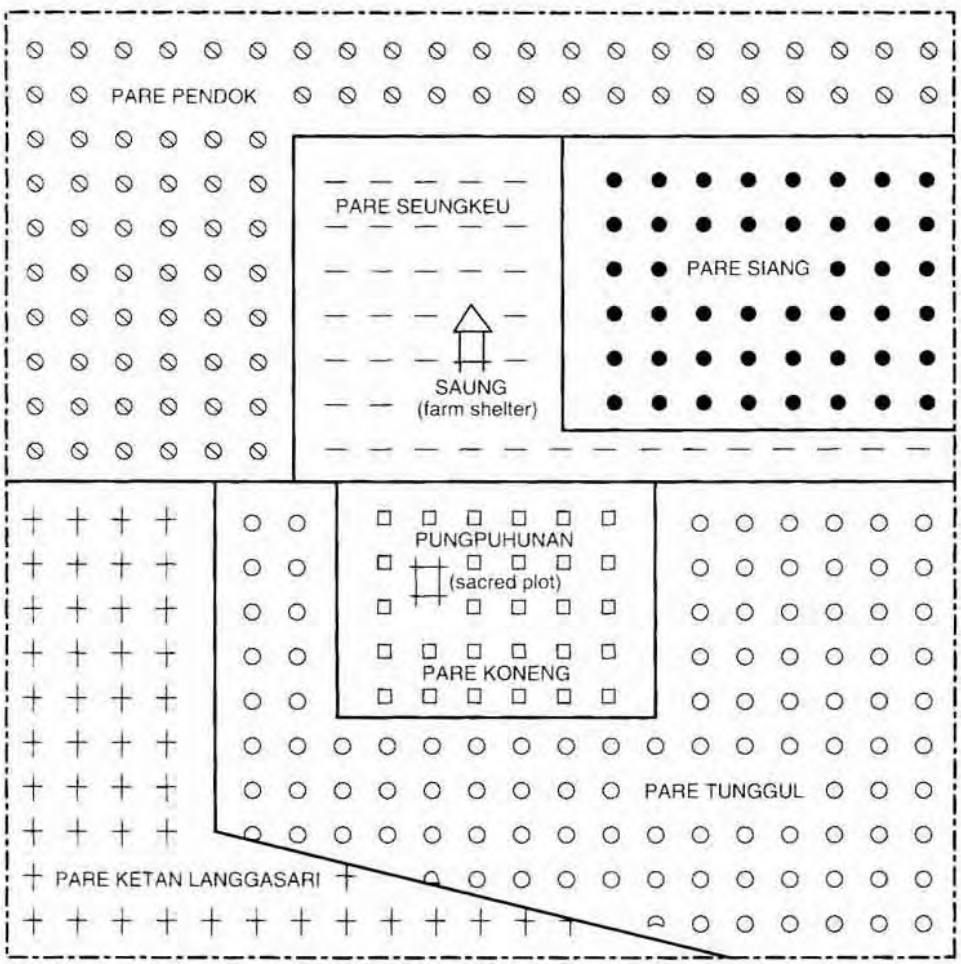

FIGURE 3.– Indicative planting pattern for different landraces in a Baduy swidden plot

After drying, about one week after harvesting, all rice bundles are carried to the settlements. In the hamlet rice is re-selected. Some marked seed rice bundles are separated and put into sacks and placed in the house, or (in the case of some Outer Baduy) a wooden trunk. Later, one or two days before planting, these bundles are threshed one-at-a-time by stamping in a large flat bamboo basket. For winnowing, a small flat basket is used. After separating out good quality seed, rice from bundles according to landrace is put into separate woven bamboo baskets or cloth sacks.

In selecting rice seed, preference is given to three landraces: 57-pare koneng, 53-pare ketan siang, and 48-pare ketan langgasari. These are all considered to be sacred, and are required to be planted by each household in separate parts of each swidden plot (Figure 3). They are not permitted to be in contact with each other, and may be separated from other - non sacred - landraces to prevent contagion. However, in addition, other landraces, including 31-pare-janah, 40-pare ketan bodas and 43-pare ketan hideung (=peuceuk), may be planted in the ***huma serang***, and for this reason are also considered sacred.

If the swidden plot of any individual household is not large enough (that is an estimated 0.5 ha) to plant at least five landraces (namely, the three sacred landraces and two others), there is no obligation to plant sacred rice. Moreover, if there is no ***pungpuhunan*** (the sacred place in the centre of a swidden field), the necessary swidden cycle rituals cannot be performed and the household must join the rituals of relatives who do have a ***pungpuhunan***. The same follows for the celebration of the communal rituals of ***kawalu*** and ***ngalaksa***, which take place after the harvesting. Similar alternative procedures exist for other rituals, such as those which occur before second weeding, before harvesting, and at the first tasting of new rice. On these occasions they join close relatives who have been asked to join in the ritual of planting rice. Thus, any household which has not planted sacred rice in the previous farming cycle but intends to plant such rice in the following year, must borrow from relatives. Indeed, this is the mechanism employed should an individual wish to plant any other landrace not planted previously. As soon as possible after the harvest, borrowed rice should be returned either by returning the same number of bundles of the same landraces or in the form of different landraces, depending on what has been agreed. In this way rice germplasm circulates and diffuses between Baduy households along kinship and affinal lines, so maintaining landrace diversity. Alternatively, the loan can be returned in terms of pounded rice rather than unpounded rice bundles, but of equivalent quantity.

Sowing.– Sowing in the ***huma serang***, ***huma puun***, and ***huma masyarakat*** commences in July-August, August-September, and September-October4 respectively, after the burning of vegetation. In the morning prior to sowing the male head of a household prepares the ***pungpuhunan***. This measures about one square metre, and is bordered by *Amomum* stems with a construction of poles, bamboo and *Arenga* leaves. At the same time, close kin with swidden plots nearby assist. A key moment in the ritual is when a couple of seeds of sacred rice, called the 'rice mother', are sown in the middle of the ***pungpuhunan***. Seven holes inside the ***pungpuhunan*** are then sown with sacred rice seeds of 57-pare koneng, while 7 holes outside the ***pungpuhunan*** are sown with seeds of 53-pare ketan siang. A couple of sacred seeds

(***sakuren***) of 48-pare langgasari, also called ***pare indung***, are additionally sown in the middle of the ***pungpuhunan***. This symbolises the 'head' and 'neck' of Nyi Pohaci.The seven holes outside the ***pungpuhunan*** represent the 'arms' of Nyi Pohaci. 48-pare langgasari from the ***pungpuhunan*** is the first landrace to be harvested, the whole stalk being pulled out intact and stored separately from the rest of the grain in the rice barn. A more detailed account of this process is provided in Iskandar (1998: 348).

At least 5 landraces are planted in the ***huma serang***, 53-pare ketan siang, 57-pare koneng, 48-pare ketan langgasari, 31-pare janah, and 43-pare ketan hideung, divided into several sub-plots marked with *Arenga pinnata* leaf ribs (***lidi kawung***). Sacred rice seeds are placed in separate parts of the swidden: 57-pare koneng, 53-pare ketan siang, and 48-pare ketan langgasari being sown at the centre, east, and west, respectively. These different landraces are not permitted to be in contact with each other. In order to ensure this, the boundaries between them are planted with other non-sacred landraces (Figure 3). Baduy believe that this prohibition has an important practical function: to maintain the distinctiveness of the different landraces by ensuring that each sacred type can be harvested (***dibuat*** or ***dipanen***) and separated (***dipasing***) easily and its purity more easily guaranteed. In practise, some mixing is likely. A similar reasoning is connected to the prohibition on sacred rice not coming into contact with the farm house. In wet rice cultivation, where HYVs predominate and where sickles have replaced finger-knives, the harvesting and selecting of seed of non-HYVs becomes difficult, and after one year can no longer be used for planting in the next season, as the seed is no longer homogeneous. If such seed is planted, rice will grow as a mixture of different heights and produce a low yield. As a result, in non-Baduy lowland areas seeds are usually bought rather than being homegrown. But such seed can be used only for one farming season, and in the following year new seed must be bought again. Farmer independence is therefore restricted with more dependence on market-led inputs and energy subsidies from outside, over which Baduy have no control (Iskandar 1998: 473-474).

We have no data to suggest that two or more Baduy rice landraces might ever be sown in the same hole, while only a few landraces have disappeared because they have been planted in contact with others and during harvest could not be easily separated. These are generally those which have similarities in grain colour and shape. For example, if there is crop failure in a swidden, or the crop grows badly, 44-ketan kasumba, 30-hawara koas, 47-ketan jalupang, and 78-pare sereh will commonly be planted as a replacement (***pikeun ngayum***), mixed with other landraces. These are recognised as maturing more quickly (***pare hawara***), and can be harvested in less than 5 months. However, apart from 44-ketan kasumba, which has a very distinctive bluish-red (violet) seed colour (***kasumba***), these landraces have seeds of similar colour and shape.

Tables 4 and 5 compare rice landraces planted by 16 Outer Baduy households in 1985 and 1995. In 1985 the total number of landraces planted in the sampled households was 42, the range for number of landraces planted between 5 and 18, and the mean number per household 9.06, and each landrace was planted by a mean of 3.45 households. By 1995, the total number of different landraces for the

TABLE 4.– Rice landraces planted by 16 households in Outer Baduy in 1985

Rice Landraces	Respondents																No. of respondents planting landrace
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1. pare ambu ganti								x			x						2
2. pare anjeni					x												1
3. pare areuy				x		x		x									3
4. pare bangban						x				x							2
5. pare bayur								x							x		2
6. pare bentik		x	x				x	x		x		x		x	x		8
7. pare bongkok								x									1
8. pare bubuay	x							x								x	3
9. pare bunar	x																1
10. pare buntut menjangan						x											1
11. pare cao				x		x	x								x		4
12. pare cikur												x					1
13. pare cinggir								x									1
14. pare hawara koas						x											1
15. pare ketan kasumba				x						x							2
16. pare ketan bulu kuda						x											1
17. pare ketan hideung/ peuceuk		x								x		x					3
18. pare ketan jalupang		x															1
19. pare ketan langgasari*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
20. pare ketan putri				x													1
21. pare ketan kidang				x													1
22. pare koneng*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
23. pare konyal				x													1
24. pare limar				x			x					x			x		4
25. pare lopang				x													1
26. pare malati				x		x	x					x			x		5
27. pare mananggul					x				x								2
28. pare marukan		x									x						2
29. pare menteng				x	x	x	x					x			x	x	7
30. pare pendok leger	x	x		x			x	x			x	x					7
31. pare racik			x				x		x			x		x			5
32. pare rumbay					x												1
33. pare sabeulah									x								1
34. pare sampay				x													1
35. pare sereh		x		x							x	x		x	x		6
36. pare seungkeu						x	x	x				x	x				5
37. pare seuti													x				1
38. pare siang*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
39. pare singgul			x										x				2
40. pare tanggay				x													1
41. pare tanjung				x													1
42. pare tunggul					x	x			x					x			4
Total in each household	6	9	6	18	8	13	11	12	7	7	7	13	6	7	10	5	

TABLE 5.– Rice landraces planted by 16 households in Outer Baduy in 1995

Rice Landraces	Respondents																No. of respondents planting landrace
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1. pare areuy						x											1
2. pare bangban																x	1
3. pare bentik					x		x			x	x	x				x	6
4. pare beunteur	x									x							2
5. pare bologor											x	x					2
6. pare bunar									x								1
7. pare cao	x		x		x	x	x					x		x			7
8. pare cokrom								x		x		x					3
9. pare hawara kaos														x			1
10. pare ketan hideung							x										1
11. pare ketan jalupang										x		x					2
12. pare ketan langgasari	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
13. pare kapundung			x						x	x							3
14. pare kohak												x					1
15. pare koneng	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
16. pare konyal	x														x		2
17. pare limar							x					x		x		x	4
18. pare malati												x					1
19. pare marukan	x									x							2
20. pare menteng			x	x					x								3
21. pare ninggul				x													1
22. pare pendok		x											x				2
23. pare reumay																x	1
24. pare rumbay	x			x	x	x			x								5
25. pare sabeulah									x								1
26. pare sereh				x												x	2
27. pare seungkeu	x	x		x			x					x	x				6
28. pare siang	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
29. pare sikep			x														1
30. pare sintung															x		1
31. pare tundun											x						1
32. pare tunggul		x								x			x				3
33. pare wanti	x		x														2
Total in each household	10	6	8	8	6	6	8	4	8	10	6	12	6	6	5	8	

same households had decreased to 33, the range for the total number of landraces planted was between 5 and 12, the mean number per household had declined to 7.31, and each landrace was planted by a mean of 3.54. The decline in the number of landraces over this ten year period can be attributed to land shortage, as a strong correlation can be shown between size of swidden plot and number of landraces planted. Thus, given that 1 rice bundle is sufficient for planting 0.1 ha, and that usually one bundle of each landrace will be planted, a swidden plot of 0.5 ha will contain 5 landraces, one of 0.6 ha 6 landraces, one of 0.8 ha 8 landraces, and so on.

TABLE 6.– Rice landraces planted by 11 households in Inner Baduy in 1995

Rice Landraces	Respondents											No. of respondents planting landrace
	1	2	3	4	5	6	7	8	9	10	11	
1. pare baduyut											x	1
2. pare bangban										x		1
3. pare banter										x		1
4. pare bentik										x		1
5. pare beunteur			x								x	2
6. pare biluk		x								x		2
7. pare cokrom	x											1
8. pare hawara										x		1
9. pare janah	x											1
10. pare jeruk			x	x								2
11. pare kapundung					x					x		2
12. pare ketan areuy			x							x		2
13. pare ketan huis/bodas			x		x				x	x		4
14. pare ketan keuyeup			x									1
15. pare ketan langgasari	x	x	x	x	x	x	x	x	x	x	x	11
16. pare ketan nangka			x									1
17. pare ketan peuceuk/ hideung			x						x	x		3
18. pare kiara		x			x							2
19. pare kolelet					x						x	2
20. pare kohak											x	1
21. pare koneng	x	x	x	x	x	x	x	x	x	x	x	11
22. pare konyal				x		x	x	x		x		5
23. pare leungsir					x					x		2
24. pare limar	x		x	x			x					4
25. pare menteng							x			x		2
26. pare menyan		x			x	x					x	4
27. pare nagayanti										x		1
28. pare pendok	x											1
29. pare racik										x	x	2
30. pare sabeulah											x	1
31. pare salak					x							1
32. pare sereh		x									x	2
33. pare seungkeu	x				x			x		x		4
34. pare siang	x	x	x	x	x	x	x	x	x	x	x	11
35. pare singgul		x										1
36. pare sintung			x									1
37. pare tanggay		x						x				2
38. pare tapos		x										1
Total in each household:	8	10	12	6	11	5	6	6	5	18	11	

The landraces disappearing from the swiddens of the sampled households between 1985 and 1995 include 2-pare ambu ganti, 3-pare anjeni, 11-pare bayur, 17-pare bongkok, 19-pare bubuay, 20-pare buntut menjangan, 24-pare cikur, 25-pare cinggir, 44-pare ketan kasumba, 41-pare ketan bulu kuda, 51-pare ketan putri,

46-pare ketan kidang, 61-pare lopang, pare mananggul, 71-pare racik, 76-pare sampay, 82-pare singgul, 84-pare tanggay and 85-pare tanjung. However, although there is a net decline in the number of landraces for these households for the period 1985-95, the plots surveyed in 1995 also contained 11 landraces not observed for the same households in 1985 (13-pare benteur, 16-pare bologor, 26-pare cokrom, 35-pare kapundung, 55-pare kohak, pare 68-ninggul, 72-pare reumay, 81-pare sikep, 83-pare sintung, 87-pare tundun and 89-pare wanti). This suggests that landraces are continuing to circulate between households.

Table 6, by comparison with the Outer Baduy data summarised in tables 4 and 5, concerns landraces planted by 11 Inner Baduy households in 1995. Although we do not have corresponding information for 1985, it can be seen that the number of landraces is 38, the range for the number of landraces planted between 5 and 18 and the mean number per household 9.54, while each landrace was planted by a mean of 2.58 households. These Inner Baduy data not only indicate that Inner Baduy households are more likely to conserve landraces, but that this is correlated in part at least to a larger average swidden size. It should also noted that in all cases there is a strong correlation between frequency of landrace planted, the extent to which it is conserved and the requirement that it be planted in a ***pungpuhunan*** or ***huma serang*** (12-pare bentik, 22-pare cao, 48-pare ketan langgasari, 57-pare koneng, 64-pare menteng, 69-pare pendok leger, 78-pare sereh, 79-pare seungkeu, 53-pare ketan siang, 60-pare limar, 40-pare ketan bodas, 65-pare menyan).

FIGURE 4.– Harvesting rice using a finger knife

Crop maintenance and protection.– After sowing, the next important task necessary to ensure a successful rice harvest is weeding and control of pests. Weeding is usually done twice. The first weeding is undertaken about two weeks after sowing and approximately finished about 40 days after planting. A few weeks later the swidden is already regrown with weeds, and a second weeding must be undertaken. At the same time, rice is fed with traditional herbal pesticides between five and nine times, industrial pesticides being strongly prohibited for cultural reasons. These former are made of ***cangkudu*** (*Morinda citrifolia*) fruits mixed with ***laja*** (*Languas galanga*), green coconut milk (*Cocos nucifera*), orange peel (*Citrus grandis*), fermented palm sugar juice (*Arenga pinnata*), and kitchen ash, spread by hand over the swidden. In addition, leaves of ***kanyere*** (*Bridelia monoica*), ***bungur*** (*Lagerstromia* sp), and ***walang*** (Zingiberaceae sp.), are burned twice a day in the farm shelter, and at various places in the swidden. These contain chemical poisons which together with the smoke from the burning are believed to deter insect pests, such as ***kungkang*** (the coreid bug, *Leptocorisa acuta*).

Harvesting.– Five months after sowing, or in the month of Kasa (January-February), Karo (February-March) and Katiga (March-April), rice in the ***huma serang***, ***huma puun***, and ***huma masyarakat***, respectively, matures and is ready to be harvested. Three days before harvesting a special ritual named ***mipit*** is performed. This involves an offering to the rice soul to ensure that it does not desert the plant during reaping. Rice is then harvested (Fig. 4) by men, women, and children working in groups consisting of husband, wife, sons, daughters, and close relatives.

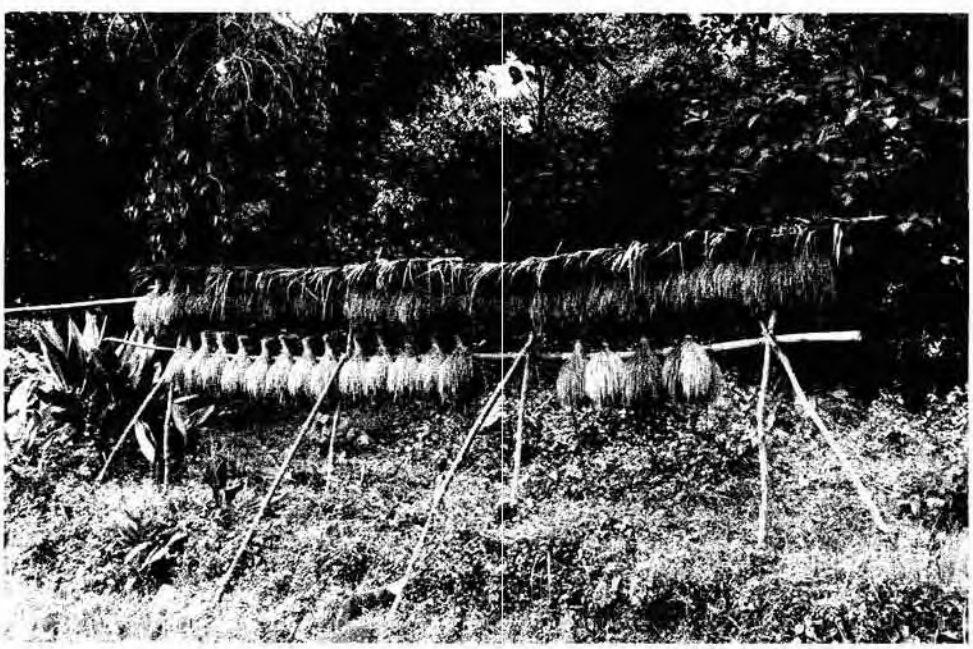

FIGURE 5.– Harvested rice bundles of various landraces, protected by sago palm thatch, awaiting transport to the settlement for storage

Harvesting rice is mostly achieved through labour-exchange between kin and friends. Each participating household must later be repaid, only sometimes in the form of rice.

Reaping is undertaken using a finger knife (***etem***, or ani-ani in Javanese). Rice panicles are cut individually using the right hand and after cutting about five panicles, these are held in the left hand and each fistful put on the ground. About four fistfuls are tied together with bamboo string, to form a bundle (***sapocong***). These procedures are difficult to perform using HYV varieties because the panicles are too short, the seeds easily drop off, and because the panicles are not easily bundled. Indeed, it has long been suggested that one of the main reasons for the extent of traditional rice diversity lies in the use of the finger knife; an implement which cuts panicles individually being more likely to register any variation from the norm for the harvester (Grist 1953: 59-60; c.f. Grist 1986:167-8). Moreover, in the Baduy case, each landrace is harvested separately, in its own block.

After about a week all rice has been completely harvested. The rice bundles are carried by the men on their shoulders using a wooden or bamboo pole, or carried by the women in the small of the back or at the hip with the help of a cloth sling. The bundles are then hung on a bamboo pole, supported by other bamboos to the height of about two metres, which is placed near the farm shelter (see earlier discussion of selecting seed). Each ***jajalon*** (one meter piece of sago palm thatch) consists of two rows on which 20 ***beungkeut*** or ***pocong*** (rice bundles) are hung (Fig. 5).

Storing.– After the harvest, the final stage of swidden farming is to carry rice to the settlement and place it in a rice barn. Rice is usually carried by household members, exchange-labour, or wage labour. According to Geise (1952)5, before the ***kawalu*** ceremony, five rice bundles are brought from the ***huma serang*** to a farm shelter (***saung***) and the panicles hung upside down. The bamboo string tying each rice bundle is replaced by bark cloth (***tali teureup***). This rice is not hung on the bamboo pole together with ordinary rice, but is brought directly to the shelter. Five rice bundles of 5 different landraces are dried: 31-pare janah, 53-pare ketan siang, 53-pare ketan putri, 44-pare ketan huis, and 52-pare ketan peuceuk (43-pare ketan hideung). After drying, these bundles are stacked in the required way and covered by ***mara asri*** leaves (*Macaranga sp*). The rice is brought to the hamlet to be pounded, carried by hand, as it is prohibited to carry it on the shoulder. The bundles are put in the house of the ***girang seurat***, covered by a sacred cloth and perfumed. On the following day, in the early morning, the bundles are brought to a pounding shelter (***saung lisung***) by a group comprising 5 women: 31-pare janah is brought by the ***puun***'s wife, followed by ***ambu seurat*** carrying 53-pare ketan siang, while 51-pare ketan putri and 40-pare ketan bodas are carried by ***ambu parekan*** and the wife of a former ***puun***. These ritual arrangements contribute towards maintaining the perceptual distinctiveness of the landraces concerned.

As mentioned in connection with seed selection, rice is selected in the hamlet. Six rice seed bundles of good quality from different landraces are separated for planting the following year. These are usually stored in a special place in the rice barn or house, separated from the rest of the rice. In addition, 30 rice bundles are

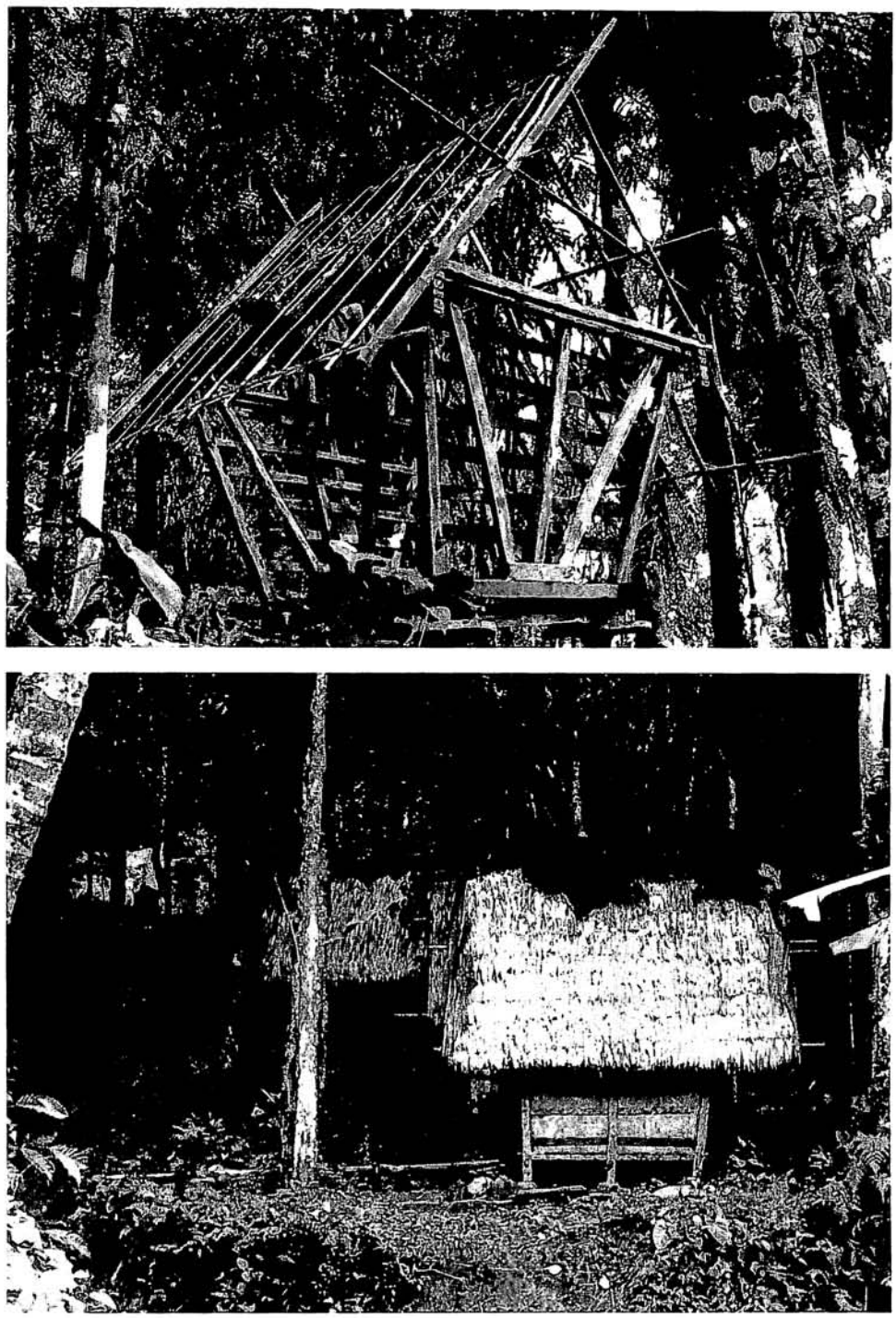

FIGURE 6.– Internal framework(a) and (b) external view of a Baduy rice barn

selected for use in various rituals, such as ***ngadiukeun pare***, the ritual associated with putting rice in a barn. This requires several bundles of **pare indung**, 'rice mother', ***pasangan indung***, 'rice couple' and ***panganteur***, 'companion', ***nganyaran***. The other rituals for which these bundles are used include that for tasting new rice (one or two rice bundles), the Dangka ***ngalaksa*** (one or two rice bundles), and the Inner Baduy ***kawalu*** (one or two rice bundles). ***Ngalaksa*** means 'making ***laksa***'; ***laksa*** being a noodle made from flour of ***huma serang*** rice (in Inner Baduy) or of ***huma jaro dangka*** rice (in Outer Baduy). The rice used must have been taken from 7 rice stalks of the ***pungpuhunan*** rice. The ***pungpuhunan*** - as we have seen- is the most sacred place in the swidden plot, regarded by Baduy as the essence of the earth, and this essence is believed to be absorbed by rice grown within it.

Rice seed and rice bundles for use in rituals are placed in the house, while the rest are stored in a rice barn (***leuit***, Fig. 6). Before rice is stored in the barn, the ritual of ***nganyaran***, 'the first tasting of rice' is performed. A special meal of steamed glutinous rice (***kejo ketan***), steamed swidden rice (***kejo huma***) and freshwater fish is provided and the new rice tasted. At this time, each household sends a meal of new rice to close relatives and friends, and in return will receive new rice meals from others. From this point onwards new rice may be permitted to be consumed by each household.

Another ritual performed at this stage involves placing the 'rice mother' (***pare indung***) in the barn: ***ngadiukeun pare indung***, 'to place mother rice'. This is performed on the same day as planting rice. The performance begins with the upper part of the rice panicles harvested from the ***pungpuhunan*** and ***mupuan*** or ***mipit*** being cut to flatten the upper part of the panicles. This rice is divided into three bundles (***ranggeong***): 'the rice couple', 'male and female' (***bikang jeung salaki***), and one bundle of 'companion' (***saranggeong panganteur***). The 'rice couple' is tied with various plants, such as leaves of ***kukuyaan*** (*Kibara coricea*), ***kakandelan*** (*Hoya difesifolia*), ***ilat mintul*** (*Scleria purpurascens*), ***tumbueusi*** (*Phyllantus niruri*), ***mara asri*** (*Macaranga triloba*), ***areuy geureung*** (*Stephania javonica*), ***pacing*** (*Costus speciosus*) and ***teureup*** (*Ficus elasticus*). Some of these plants are placed on the woven bamboo wall of the rice barn, being species considered to be those loved by Nyi Pohaci and to have symbolic functions. The ritual is aimed at welcoming the rice goddess back home (to the rice barn).

The rice is wrapped in white cotton cloth (***boeh***) and carried by a woman (***bikang***) to the rice barn. In the barn the rice is put (***dielep***) in the middle by a man, and other rice bundles placed round it. Over three days and three nights, ***gharu*** incense (*Gonystylus macrophyllus*), ***pisitan*** peel (*Lansium domesticum*), and the root of ***jambaka*** (*Dianella nemurosa*) is burned inside the barn. ***Jaringao*** (*Acorus calamus*), ***cikur*** (*Kaemferia galanga*), ***panglay*** (*Zingiber cassumunar*) and water are spread inside and outside the rice barn. Moreover, throughout the year, every time rice is taken from the barn (***nguyang***) for pounding, betel leaves, lime, gambier, *Areca* nut, and ***panglay*** are chewed and spread on the rice barn to 'awaken' the rice (***ngahudangkeun pare***). Finally, after all the rice has been stored, and between two and five times a week, rituals are performed to respect Nyi Pohaci, which involve the further burning of *Gonystylus*, *Lansium* peel, ***nangka beurit*** (*Artocarpus integra*) peel, and *Dianella* root.

Most of the plant medicines used in swiddening and in the rice barns are typified by strong aromas, and some have long been recognised as traditional insecticides in some Asian countries. For example, the fruit peel of *Lansium domesticum*, when burned, gives an aromatic smell and in the past was used by the Javanese to drive away mosquitos (Burkill 1935: 1316). Similarly, *Acorus calamus* was used in China and India to control fleas and lice (ibid: 37). On the evidence of Baduy who have moved to government resettlement schemes, chemical fertiliser application and pesticides reduce the storability of seed rice. Since Baduy rice is not contaminated with chemical fertilisers and pesticides, we suggest that this is the reason why rice can be stored in the rice barns for between 10 and 90 years, and transmitted across several generations through inheritance.6 Most couples who have been married several decades have usually between 2 and 5 big rice barns encircling the settlement, each containing between 800 and 1200 rice bundles. This rice is inherited by the children on the death of a parent, when it is divided equally irrespective of sex, after reducing it by two thirds (one third for the cost of the death ritual, and one third for the surviving spouse).

CONCLUSION

Javanese lowland irrigated rice farming has changed from a subsistence to a semi-commercial or commercial system following the introduction of a Green Revolution programme in the early 1970s. This programme has tended mainly to emphasise an increase in productivity at the expense of other key emergent properties of the agroecosystem necessary to achieve sustainability: stability and equitability (Conway and Barbier 1990: 37-48). Thus, although the productivity of wet rice cultivation has risen, Green Revolution technology has resulted in increased social differentiation, the undermining of the position of women in the rural labour force, pest infestation, water pollution arising from the application of nitrate fertilisers and pesticides, and the erosion of rice germplasm diversity (see Timmer 1973; Collier et al. 1973; Ihalauw and Utami 1975; Palmer 1976; Alexander and Alexander 1982; Husken and White 1989; Fox 1991; and Lansing 1991).

Unlike modern irrigated rice cultivation in Java, Baduy swidden farming is still strongly embedded in other aspects of traditional culture. Practising swidden farming is considered to be the main obligation of their religion. In other words, we can identify other important cultural objectives related to farming (such as stability, equitability, and continuity) in addition to productivity. Modern technologies to increase productivity, such as High Yielding Varieties (HYVs) of rice, chemical fertilisers, pesticides, tilling land, and irrigation techniques are not only not used but are culturally proscribed. Although rice productivity is low, loss of local rice varieties, environmental pollution, and social differentiation have been avoided. Baduy have a high crop diversity achieved through intercropping and multiple cropping in swidden plots, while their rice landraces are resistant to pest damage and are more efficient in using solar energy and soil minerals. In addition, their swidden system has an important role in maintaining the gene pool of various crops, including rice varieties *in situ*. Such local landraces are potentially available for use in the future to obtain new varieties more resistant to pests and

drought, and to confer other advantages such as culinary preference.

It can therefore be seen that the requirements of maintaining a separate cultural identity, the centrality of upland rice swiddening to this identity, and the success the Baduy have had in retaining their identity, has had some very specific consequences for the conservation of traditional rice varieties. Thus:

1. The maintenance of upland swidden cultivation techniques in itself has necessitated the retention of local rice varieties.
2. Specific religious requirements ensure that certain specific varieties are preserved.
3. There is a cultural value placed on diversity itself in the rice crop which is reflected in the number of landraces and in planting patterns.
4. Techniques of selection, planting, harvesting and storage ensure the preservation of the distinctiveness of individual varieties.
5. The acceptability of purchased rice for ordinary meals, the storage potential of the varieties grown and the use of effective storage practices, all ensure the preservation of some genetic material for up to 90 years before replanting.

It has long been recognised (e.g. Vavilov 1926) that centres of landrace diversity are important as pools of genetic resources for crop improvement, and that these are endangered by the ecological simplification which accompanies agricultural modernisation and rural social change (Hawkes 1983). Although cultural conservatism of the kind described here might arguably also result in genetic 'bottlenecking', the Baduy case is clearly an important addition to our knowledge of traditional (folk) in situ cultivation, and in a time of increasing environmental instability in the traditional wet rice heartland of Asia, a valuable genetic resource in the face of uncertainty.

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NOTES

1. Until recently, it was conventional to divide *sativa* rice into three taxonomic groups: *japonica*, (or *sinica*), *indica* and *javanica* (e.g. Barker, Herdt and Rose 1985: 14). According to Vergara and De Datta (1996: 109), javanicas should now be assigned to the *japonica* group on the basis of chemotaxonomy. *Indica* cultivars are mostly tropical, and are characteristically tall, leafy, high tillering, prone to lodging, respond poorly to fertilisation (particularly

to nitrogen), are photoperiod sensitive, hardy, disease resistant, tolerate unfavourable growing conditions and produce reasonable yields under conditions of low management. *Japonica* cultivars, by contrast, are mostly temperate, with short stiff straw, less tillering, are less leafy, resistant to lodging, photoperiod insensitive and early maturing. Within the japonicas, cultivars traditionally described as *javanica* are tropical, low tillering, not easily lodged, photoperiod insensitive, cool temperature tolerant, with a relatively long maturation period, wide leaves and tall sturdy stalks, long panicles, not easily shattering, of large and bold grain type, and of intermediate rice texture (Barker, Herdt and Rose 1985: 16; Fox 1991: 64).

2. By comparison, in southeast Asia, Conklin (1992, unpubl., see also 1980, 1988) reports 85-7 landraces for irrigated Ifugao agriculture in upland Luzon. Parekesit and Hadikusumah (1997) suggest that some 88 landraces were found in pre Green Revolution irrigated fields in West Java, and Kusnaka Adimihardja (pers. comm. to Iskandar) reports 126 landraces for wet and dry fields combined in the Kasepuhan area of West Java. For dry rice alone, Friedberg (1990: 198-200) has reported 30 landraces for the Bunaq (Timor), Revel (1990: 176-7) 36 for Palawan, Dove (1985: 159-165) a minimum of 44 planted by Kantu' (east Kalimantan) in 1975-6 swiddens, and Visser (1989: 40) 14 for Sahu on Halmahera. Thus, the number of reported Baduy varieties is comparable to the highest number reported for irrigated rice agriculture and is exceptionally high for dry rice cultivation.

3. The awn is technically a lance-shaped extension of the lemma, which with the palea forms the husk. The lemma, palea, upper and lower glume together constitute the spikelet, several of which make up the panicle, the exact number varying from cultivar to cultivar. In wild rices the awn assists in dispersing the ripe grain at seeding, a function lost in non-shattering cultivated rices (Burkill 1935: 1598).

4. Rainfall in July is 158 mm compared with 170 mm in October, while the average number of rain days for these two months is 7 in both cases. The difference in precipitation over this period of sowing is therefore minimal. However, the average altitude of Inner Baduy ***huma serang*** is higher than Outer Baduy ***huma masyarakat***, surrounded by dense forest and receiving less sunlight. The slight difference in temperature which this occasions leads to Inner Baduy ***huma serang*** rice maturing more slowly and therefore having to be planted earlier than rice in ***huma masyarakat***.

5. The Inner Baduy ***kawalu*** ceremony is difficult to observe directly as non-Baduy are not presently permitted to attend. However, descriptions obtained by Iskandar from Outer Baduy informants, and direct observation of similar ceremonies, conform generally to descriptions given by Geise.

6. Confirmation of claims for length of storage time was obtained by Iskander, who interviewed informants aged between 65 and 75 years reporting having inherited identified rice bundles from their parents. Bundles stored for more than a generation are deliberately retained as a buffer against chronic shortfalls (***bahaya kelaparan***), but as they are not known to us to have been used as seed rice during the period covered by this study, we are unable to test the claim that the germplasm is viable.

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