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Optimizing Quadrat Size and Quadrat Number for Weed Species Count Studies in Transplanted Rice (*Oryza sativa* L.)

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ABSTRACT

Generally, the weed count data exhibit significant spatial variations. Adequate sampling procedures need to be developed for acquiring true representation of weed flora. An experiment was conducted to determine optimum quadrat size and quadrat number for weed species count in transplanted rice. Characteristic curves both for species area and quadrat number first increased abruptly and then levelled off as fewer species were added with an increase whether in the quadrat size or quadrat number. It was determined that at least two quadrat each of 0.1875m^2 were needed to adequately represent the weed community.

INTRODUCTION

Weed density data are generally highly variable. The coefficients of variation of weed count as well as weed weight have been found to vary from 5 to 200 percent (1). This variability is not only inherent, but also attributable to different edaphic and biological factors. Since, a plant community is seldom homogenous throughout the field and its distribution is not uniform, therefore, it becomes difficult to obtain a representative sample of all the members in a community. However, in the absence of significant variations, a single and relatively small sample might be adequate. Most often, the information from complete count of all members in a community is neither more useful nor efficient from that obtained by sampling an adequate number of representative members.

Limited information is available on sampling procedures for weed control in transplanted rice (1). Therefore, it is of prime importance to determine what constitutes an adequate sample in terms of the community as a whole and how to obtain such a sample with appropriate sampling procedures. International Rice Research Institute (IRRI 1976) found that 0.16m^2 and 0.20m^2 were appropriate quadrat sizes for weed sampling in wetland transplanted rice. IRRI (1977) also reported the quadrat size ranging from 40cm by 40cm to 40cm by 60cm as the best for wet season rice weeds. Kim and Moody (1983b) reported that for transplanted rice, the weeds should be sampled three times with a quadrat size of 0.30m^2 to adequately represent the weed flora. They however, observed that the minimum quadrat size and minimum quadrat number depend upon the homogeneity of weed distribution and varies according to the distribution pattern of the weed densities, five quadrats ranging from 0.1875m^2 to 0.50m^2 are necessary to represent weed flora. They further noted that for three weed groups of sedges, grasses and broadleaf, quadrat sizes of 0.50m^2 and 0.25m^2 respectively with 4-5 samples are adequate to obtain representative

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weed flora.

The present study was carriedout to determine the optimum quadrat size and minimum quadrat number for sampling weed species in transplanted rice in the rice zone of the Punjab, (Pakistan).

MATERIALS AND METHODS

The experiment was conducted on farmer's field in Sialkot district (Daska) of the rice zone of Punjab. The field was under regular wheat-rice-wheat rotation. After wheat harvest, it was ploughed twice. Before transplanting, the field was puddled twice with bullocks and planking was carried out. Thirty days old nursery of Basmati-370 rice was transplanted in the first week of July, 1987. Nitrogen at the rate of 90kg/ha was applied in two equal doses; at 30 days after transplanting and at panicle initiation. All the phosphorus was applied at the land preparation stage. Six replication were used from the field under study to ensure sufficient representation.

The ensure sufficient weeds for sampling, the field was not weeded. The weeds were sampled at 30 days after transplanting (30 DAT) beacuse the floristic composition of the transplanted rice field was distinct at that time. Seven different quadrat sizes of 25 x 25cm, 25 x 20cm, 25 x 75cm, 25 x 100cm, 50 x 50cm, 75 x 50cm, and 50 x 100cm were tried. The experiment was laid-out in a randomized complete block arrangement with six replications. Weed density data were obtained by superimposing one quadrat upon the other, starting from the smallest size. Weeds were pulled out of the ground, washed and counted by species. For each quadrat five samples were taken from each plot. For the estimation of dry weight, the weeds were dried at 100° for 48 hours. Species-area curve technique was used to find out the minimum quadrat size and minimum number of quadrats to acqire a representative sample of weed community. The number of species in each increasing size quadrat was recorded and tabulated. A graph was drawn with the size of the quadrat on the x-axis and the corresponding number of species on the y-axis. Cain's (1938) producedure was adopted to arrive at optimum quadrat size. This point occured on the curve for the optimum quadrat size where a 10 percent increase in the quadrat size yielded additional 10 percent species.

RESULTS AND DISCUSSION

The predominant weed species in the experimental field were *Marsilea minuta, Paspalum distichum and Fimbristylis littoralis*. Relative densities of the major weeds are presented in table 1. It is evident that as many as 10 weed species were found in the experimental plots. Relative density of *Echinochloa crusgalli*, was found to be the highest (43.4%) followed by *Sagittaria guayensis* (41.6%) whereas *Fimbristylis littoralis* constituted only 11.5 per cent. The occurence of the remaining seven species was rare and negligible except *Cyperus difformis* which was estimated only 1% of the weed flora.

With a view to investigate species-area relationship, a curve was drawn by plotting number of species on y-axis and size of the quadrat (m^2) on the x-axis. It was observed that the characteristic curve first rises abruptly and then levels off as the rate of increase in the number of additional species declines with an increase in the quadrat

Table 1. Relative density of different weed species in transplanted rice, 1987

Weed species	Av. Density/m² (no.)	Relative density (%)
Cyperus iria	0.37	0.2
Cyperus difformis	1.76	1.0
Cyperus rotundus	1.07	0.6
Echinochloa crusgalli	75.73	43.4
Echinochloa colona	0.37	0.2
Fimbristylis littoralis	20.11	11.5
Marsilea minuta	0.37	0.6
Paspalum distichum	1.44	0.8
Sphenochlea zaylanica	0.16	0.0
Sagittaria guayensis	72.33	41.4

size. A point was located on the curve, where amount of additional efforts due to an increase in the quadrat size do not correspond with the added species. This phenomena followed the law of diminishing returns and the usefulness of the few added species was weighed against considerable amount of extra efforts to obtain them. Hence, such a point was located where at least 10 percent increase in the quadrat size yielded 10 percent more weed species (Osting, 1956). With the help of this approach, a quadrat size of 25cm x 75cm or 0.1875m^2 was found quite adequate to sample the weed community, (fig·1). This quadrat size is almost similar to IRRI (1977) in which a sampling unit size ranging from 0.16m^2 and 0.20m^2 was recommended for transplanted rice in the Philippines.

Quadrat size of 0.1875m^2 was used to estimate the minimum number of quadrats required to estimate the weed species flora. The technique of species-area curve was again employed. The increase in the number of species was plotted against the number of samples. Following a 10 percent relationship, 2 random samples of 0.1875m^2 x or 0.375m^2 area/plot was required to adequately sample the weed flora. This area can be obtained by taking two random samples of 25cm x 75cm from each plot. Moody (1983 b) determined a sample of 2.7 quadrats with a quadrat size of 0.32m^2 to adequately sample the weed flora in transplantd rice in Korea. It is therefore, suggested that in transplanted rice; fields with almost similar weed flora as observed in the Daska area of the rice zone of the Punjab, the weeds may be sampled with a quadrat size of 0.1875m^2 with at least two samples/plot. However, the minimum quadrat size as well as the quadrat number will depend upon the homogeneity of weed distribution and will vary according to the distribution pattern of weed species.

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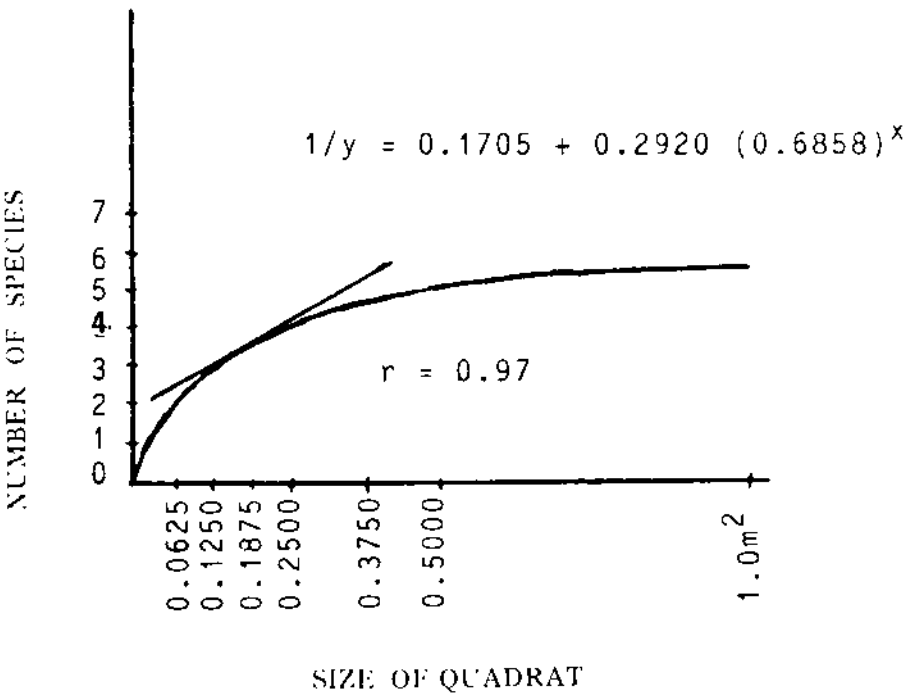

Fig. 1 Relationship between number of weed species and size quadrat in the Rice zone of Punjab, 1987.