SUMMARY

This study deals with the outcome of the analysis of seeds, fruits and other macroscopic plant remains from the settlement site De Horden near Wijk bij Duurstede (province of Utrecht, the Netherlands). The remains generally date to the first and second century AD. From around 70 AD, De Horden, a native settlement, found itself just within the frontiers of the Roman Empire; in the early third century the site was abandoned.

From 309 soil samples, c. 55,000 plant remains, belonging to some 190 types have been identified. The main part of the investigations consists of a numerical analysis of the carbonised plant remains, which comprise c. 88% of the material.

The empirical distribution of the number of remains and types per sample is found to accord with the theoretical distribution known as R.A. Fisher's 'Logarithmic Series'. For the empirical distribution of the number of occurrences and remains per type no theoretical counterpart has been found, although this distribution too is quite regular. This suggests that random processes of dispersion play an important part. The empirical distributions have served to identify deviating samples or types of plant remains.

The numerical treatment of the material is based largely on the application of the multivariate approach of Correspondence Analysis. From a series of analyses of the total collection and some subsets of data it appears that two ordering principles underlie the distribution of the plant remains. The most important one is that the composition of samples gradually changes in the course of time: in progressively younger samples the importance of cereals decreases and that of grassland plants increases. The second ordering, which is independent of the time factor, shows a continuum ranging from samples dominated by remains of perennials to samples containing predominantly annuals.

Other archaeological or botanical variables have no influence on the ordinations: neither the samples' volume, the nature of the archaeological features or the part of the settlement where the samples were taken, nor the species' humidity and nitrogen requirements, growing height, or month of florescence play a part. From this it may be concluded that on the basis of distribution of the botanical material over the samples, it is impossible to reconstruct any specific 'activity areas' within the settlement. Furthermore the material provides no indication of a changing environment during the lifetime of the settlement. The contents of the samples mostly are a mixture of species associations of various origins. The differentiation of the samples along the two ordination axes generally reflects differences in the degree to which those various associations are represented.

Only a few samples are sufficiently distinct in composition to allow inferences about their origin. The two most important of these occur as opposite extremes in the samples' ordering along the time axis. One of the samples contains the remains of a grain store of the pre-Roman phase of occupation. The other sample, dating to the final phase, was found mostly to consist of the remains of a hay store.

The increasing number of grassland plants and the decline in the number of cereal remains through time point to changes in agricultural practices at De Horden. The increase in grassland plant remains in the settlement can be attributed to the improved care for livestock in Roman times. The decreasing frequency of
cereal remains from the pre-Roman period onwards suggests that field crops became less important. The archaeological investigations reveal that simultaneously the layout of the settlement changed from a loose structure to an organised one, with a growing population. The incorporation of De Horden into the Roman Empire evidently did not merely result in changing agricultural activities but also brought greater prosperity. This can be accounted for by a change in the economy: from subsistence farming in pre-Roman days, people switched to commercial production. It is likely that the farmers focussed on improved meat and hide production for the Roman market. Probably this means that dairy products also became more plentiful, which may have reduced the local need for field crops.

No typical, relatively unmixed samples were found that might provide a key to the interpretation of the second ordering. This ordering cannot be explained until it is known what kind of processes or activities underlie the generally mixed composition of the samples. One of the methods employed to reconstruct such processes and activities has been the analysis of the uncarbonised material. This has not produced unambiguous results. Unfortunately the interpretation of the second ordering remains obscure.

Nonetheless the second ordering, combined with the first, does offer some important evidence. When the two are plotted together in a single diagram, groups of associated species emerge. These groups turn out to correspond to a marked degree with ecological plant associations as distinguished nowadays. Some species, however, fall outside the groups to which they would be assigned on the basis of their present-day occurrence. Indications are that red fescue (Festuca rubra), gipsywort (Lycopus europaeus) and marsh woundwort (Stachys palustris) at De Horden grew under other conditions than expected.

The sample with the remains of the pre-Roman cereal store mainly consists of grains of hulled, six-row barley (Hordeum vulgare). The scarcity of weed seeds and the virtual absence of chaff remains indicate that this batch of grain had been threshed, winnowed and sieved. Together with some of the other samples, this sample yields information about agricultural practices. The total absence of grains of emmer wheat (Triticum dicoccum) in this sample shows that wheat and barley were grown and stored separately. The sample did contain a fairly large number of grains of - probably wild - oat (Avena fatua). This indicates that the barley had not yet been hand-sorted in the course of food preparation.

Barley, oat and wheat are the most common cereals. Given its low frequency, millet (Panicum miliaceum) is likely to have been of only minor importance. Pulses on the whole are badly preserved in the soil. Therefore the presence of a small number of peas (Pisum sativum) and Celtic beans (Vicia faba var. minor) must be taken as evidence that these were actually grown. Flax (Linum usitatissimum) will have been grown both for its fibre and the linseed oil.

Potherbs (Anethum graveolens - dill; Apium graveolens - celery and Coriandrum sativum - coriander), spelt (Triticum spelta), bread wheat (Triticum aestivum) and lentil (Lens culinaris) were encountered in very small quantities. They can be regarded as typical of Roman-style cuisine. The scarcity of these products is an indication that the Roman presence in the area hardly affected the native farmers in their choice of crops.

The virtual absence of straw remains indicates that no cereals were grown inside the settlement. The lack of samples containing typical threshing residue shows that threshing and winnowing were performed outside the settlement. Whether the sieving of the winnowed grain was done within or outside the settlement cannot
be ascertained: on the one hand there are no samples that manifestly consist of sieving residue, but on the other hand a great many remains of field weeds have been found and it is hard to imagine that these should all have originated locally, within the occupied settlement. The occurrence of seeds of low-growing arable weeds suggests that harvesting was done with a scythe or sickle. Fodder consisted of hay mixed with untreated grain, especially barley.

The sample with hay residue, dating from the final phase of the Roman-period settlement, by its species composition points to grassland of the Arrhenatheretalia-elatioris type. Grasslands of this type occur in areas that are flooded part of the year. There must have been plenty of such areas in the vicinity of De Horden, at the transition of the backswamps to the higher levees.

Application of Correspondence Analysis to the archaeobotanical data of De Horden has demonstrated that this method can indeed lead to meaningful results. Ideally, this kind of analysis should now be applied not only to the botanical data of other sites, but also to other categories of archaeological finds from De Horden. The value of the method will probably reveal itself even better in the analysis of data collections marked by greater internal differentiation than is the case at De Horden.