MG 100 Archaeobotany seminar Handout: Archaeobotanical Taphonomy, for charred seed assemblages

Institute of Archaeology 2006
Dorian Q Fuller

This hand-out includes selected diagrams on crop processing

- Minnis' taphonomic diagram, the 'catch-all' model
- Dennell's general processing assemblage formation model
- Hillman's activities and assemblages relationship diagram
- cereal disarticulation (for wheats and barley).
- G. Jones summary of processing affects of weed seed types, and statistical summary of separation of products and by-products
- C. Stevens pictorial summary of key stages in crop-processing (glume wheats) [based on Hillman 1984 and G. Jones 1987]
- Rice processing model from Harvey and Fuller (2005) based on Thompson (1996)
- Hulled milled processing model from Harvey and Fuller (2005) based on Reddy (1997)
- Pulse processing model from Fuller and Harvey (2006)
- Diagram of potential variables affecting pre-depositional, depositional, post-depositional stages of charred assemblages

A synopsis of some of the key publications in the development of thinking on archaeobotanical formation processes with bibliography is included at the end.

UCL Institute of Archaeology
University College London 31-34 Gordon Square London WC1H 0PY
Tel: +44 (0)20 7679 7495 Fax: +44 (0)20 7383 2572

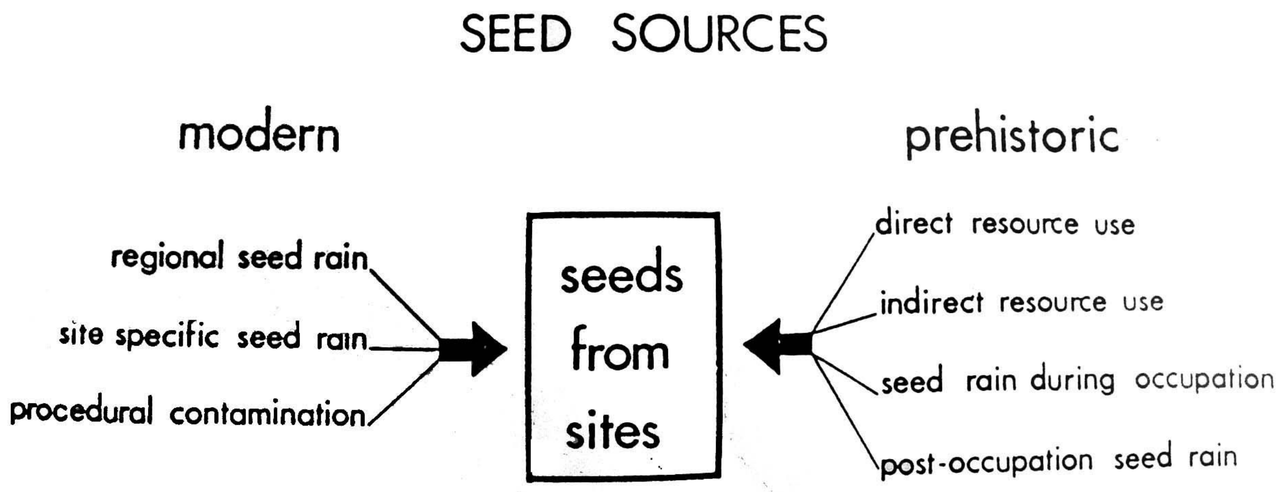


Figure 1. Sources of seeds recovered from archaeological sites.

Minnis (1981) the catch-all model of potential seed sources. Important distinction between intrusive modern and ancient material.

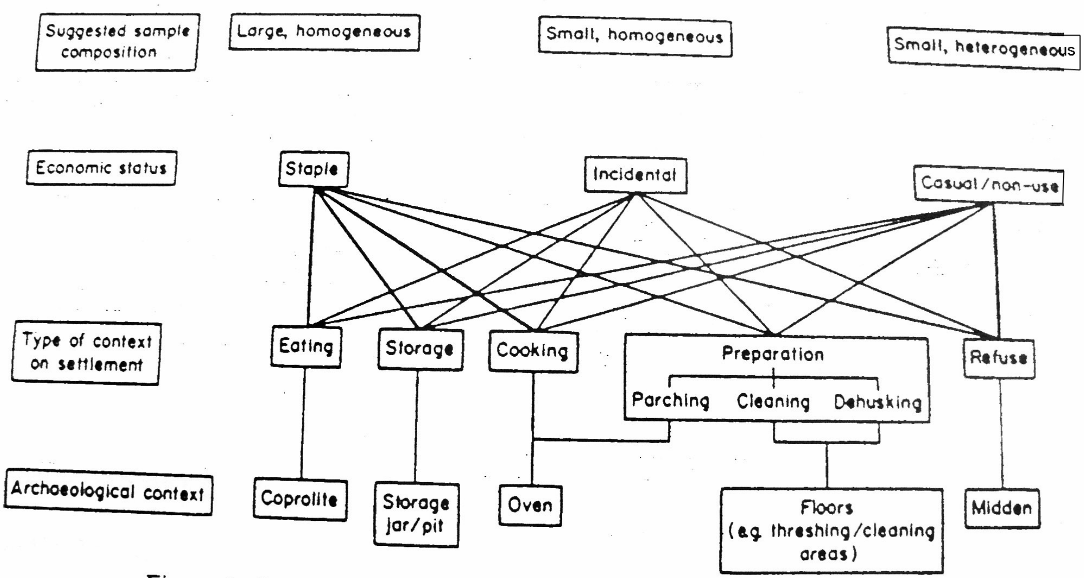


Figure 1. Suggested relationship between economic status of a plant, its archaeological context and sample composition. Width of line indicates degree of association between economic status and context.

Dennel (1976): common sense model of use type and archaeological context in relation to sample size and heterogeneity. Note the suggested relationship between larger samples and staples.

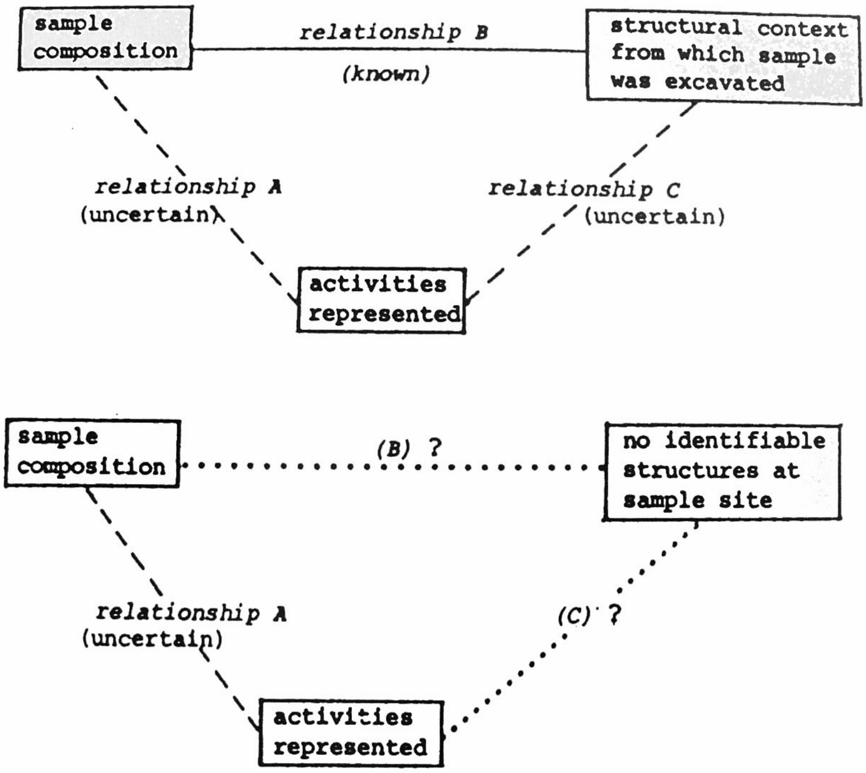


Figure 2. Two sets of relationships encountered on archaeological sites (from Hillman 1973)

Hillman's (1973) diagram of the relationships between source, context and assemblage composition.

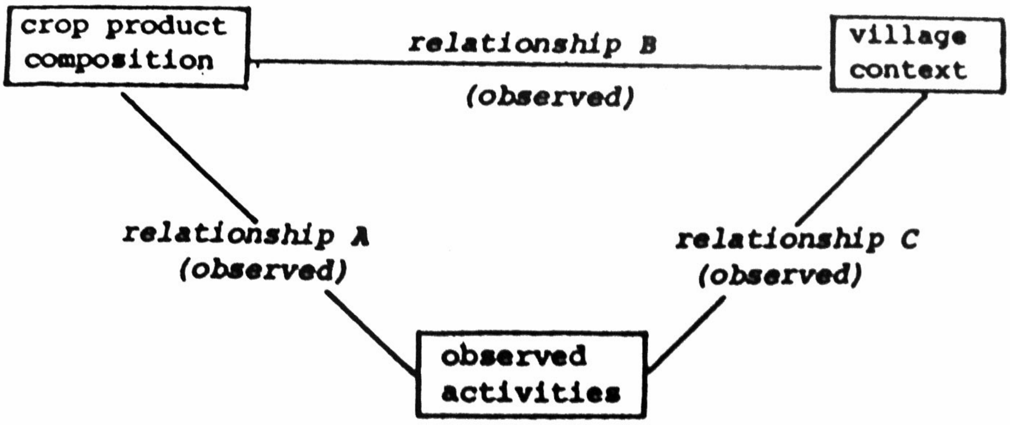
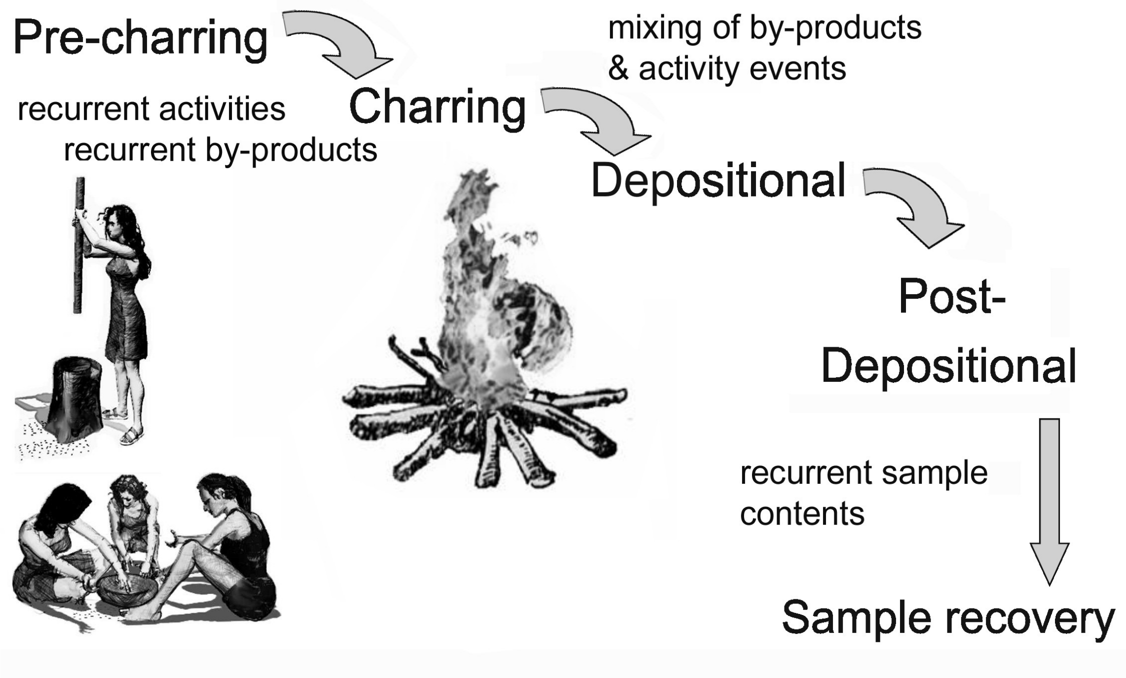


***Figure* 3. The same relationships on present-day settlements: all are observable and measurable.**

Hillman's (1973) diagram of observable relationships in ethnographic contexts: the role of ethnoarchaeology for archaeobotany.



The formation of an archaeobotanical (carbonized) sample in terms of patterning composition. The importance of considering routine activities and regular inputs to fire for preservation. (From Fuller, Stevens and McClatchie, in press).

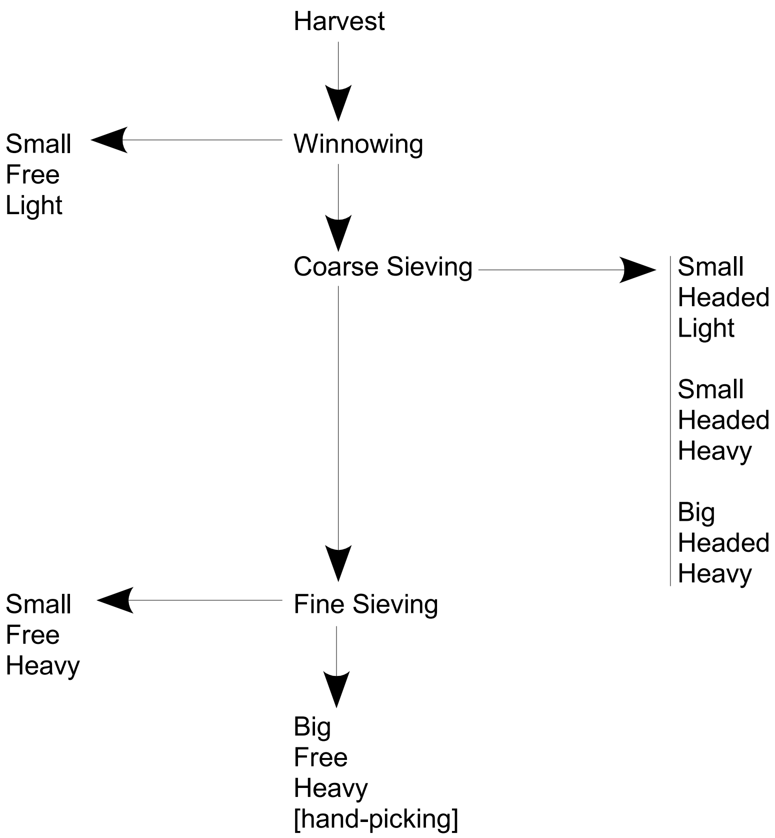
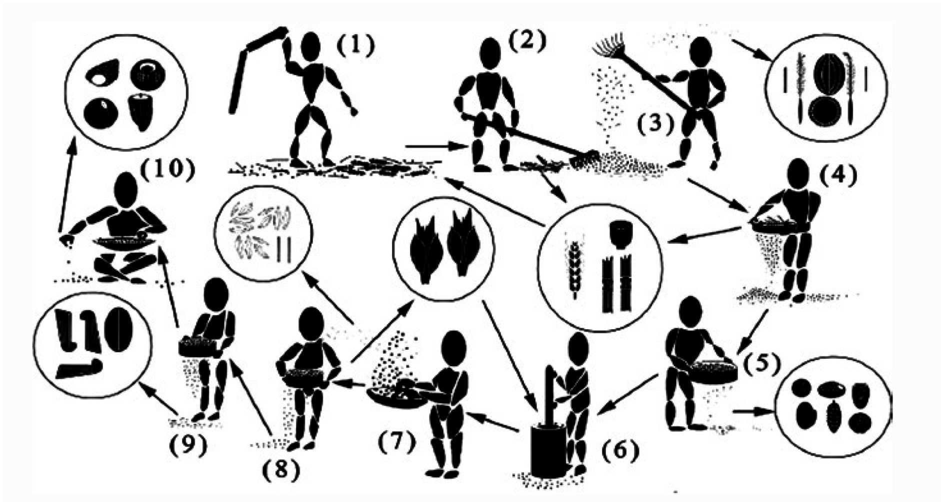
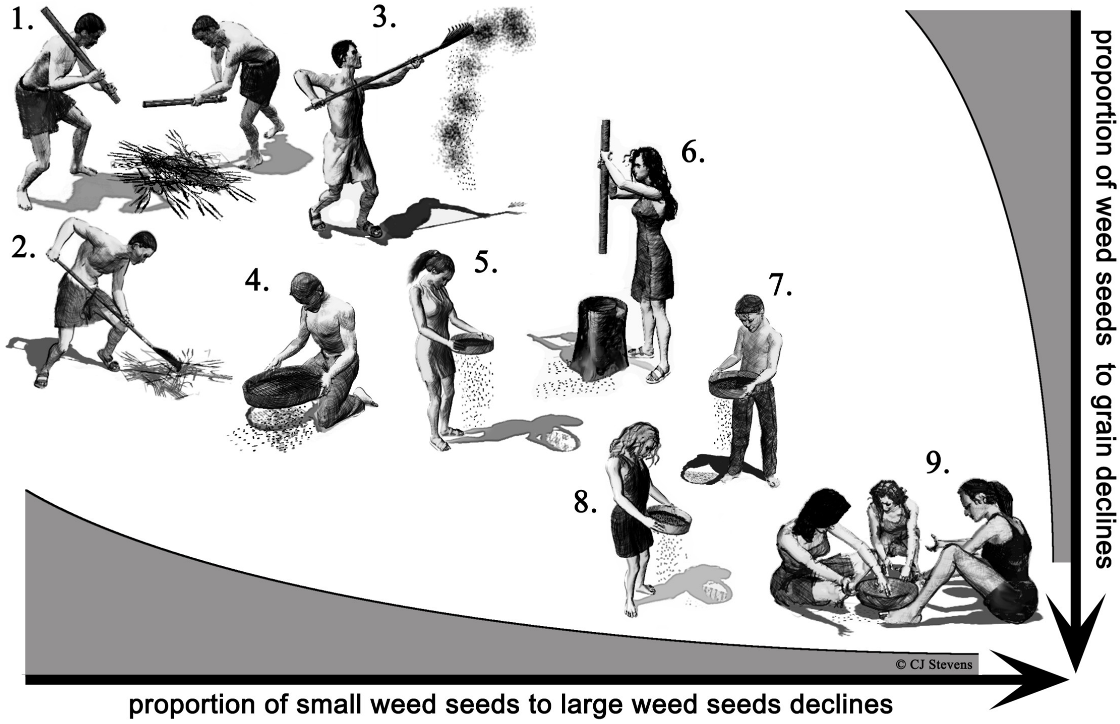


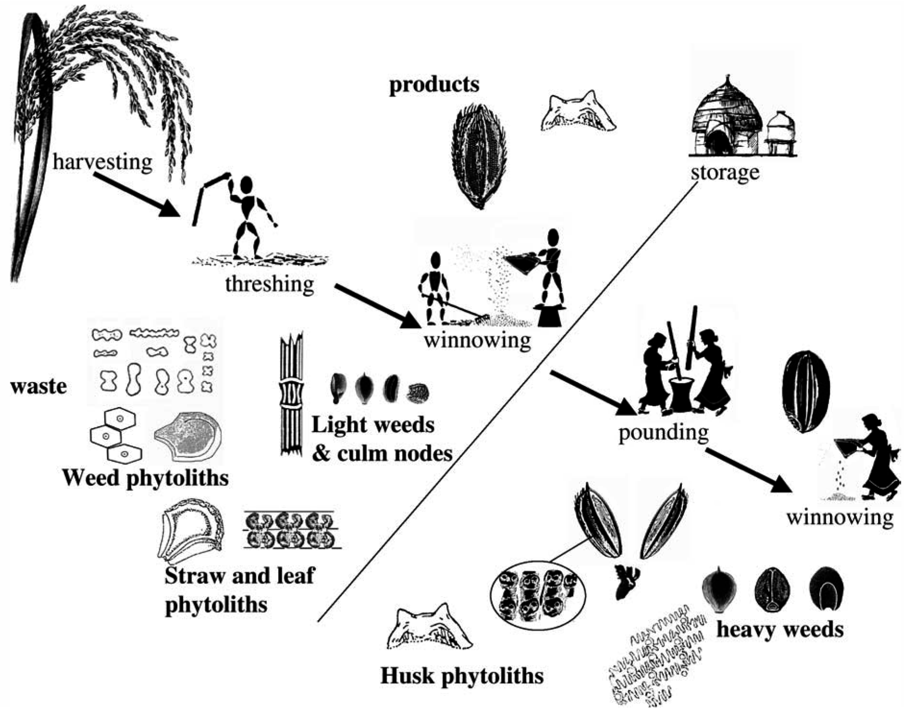
Diagram of main categories of weed seeds expected in by-products of main processing stages (after G. Jones 1984; 1987).



Cartoon of the main crop-processing stages for glume wheats (from Stevens 2003): 1. Threshing. 2. Raking. 3. Winnowing. 4. Coarse sieving [note return of some by-products to threshing]. 5. Fine-sieving. 6. Pounding (de-husking). 7. Winnowing. 8. Coarse sieving (to return undehuksed spikelet to previous step). 9. Fine sieving. 10. Hand-picking.



Schematic representation of main quantitative patterns through the course of crop-processing (from Fullerm Stevens and McClatchie, in press).



Simplified schema of rice processing (from Harvey and Fuller 2005) indicating products (top) and by-products (bottom). Potential macro-remains shown black, potential phytolith outputs shown in outline. Also below:

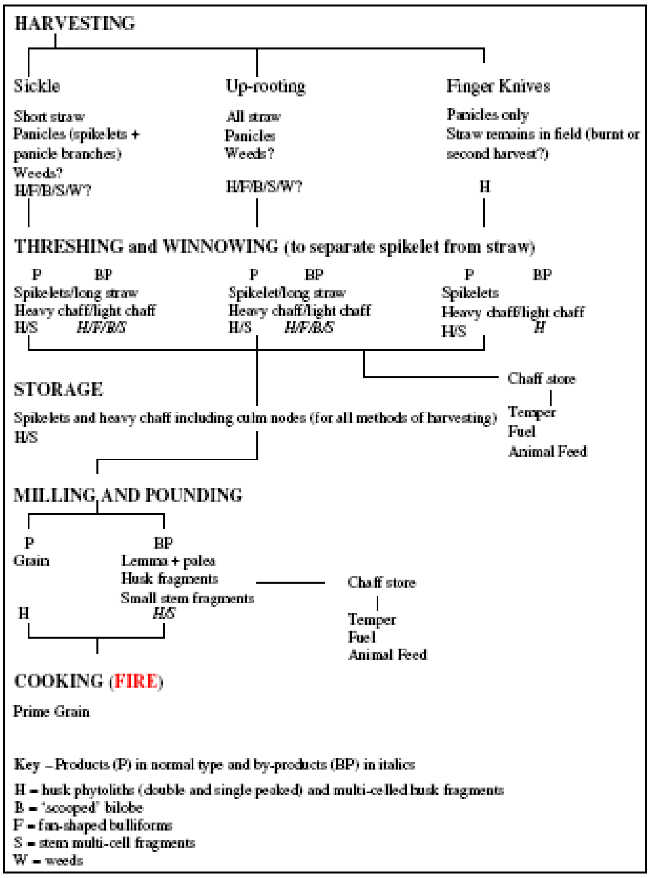


Fig. 2. Simplified outline of rice crop processing (based on Thompson [69]).

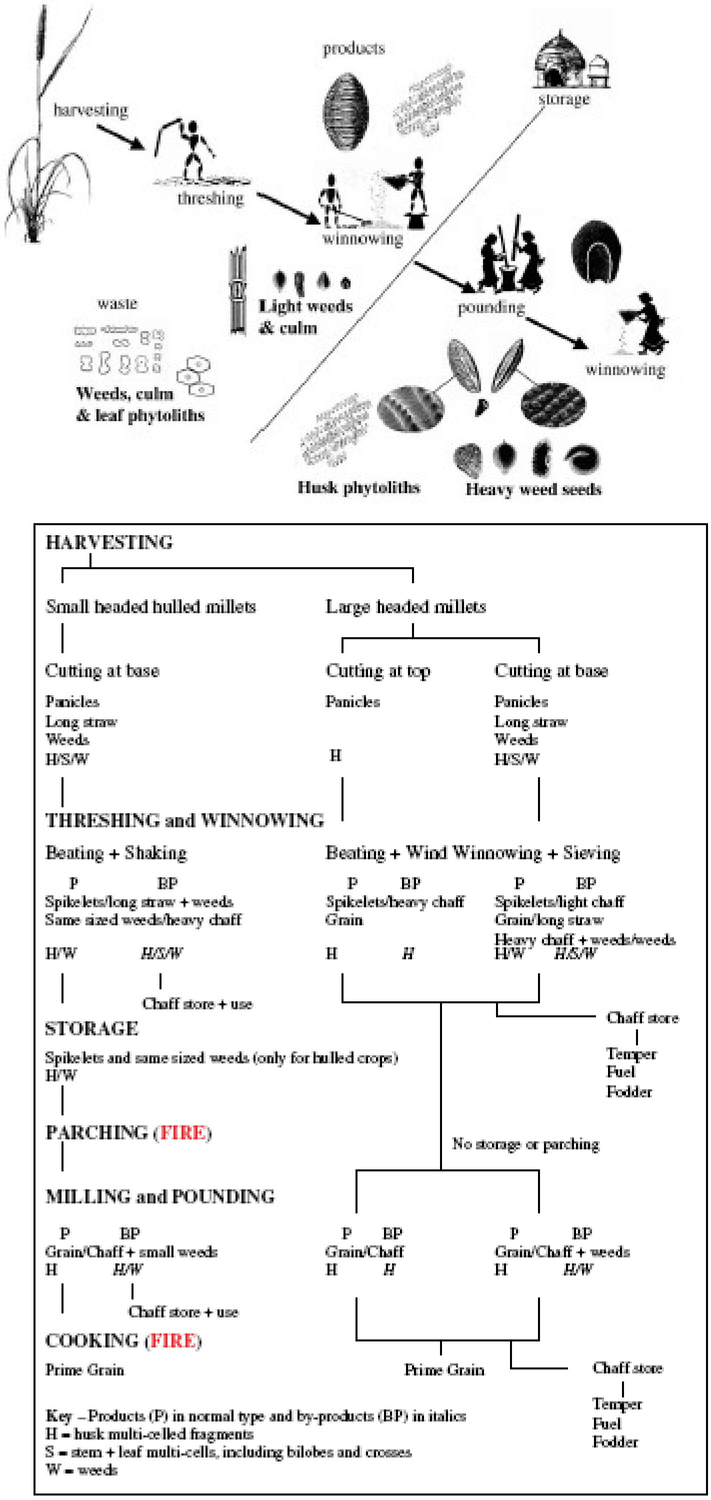


Fig. 4. Simplified outline of millet crop processing (based on Reddy, unpublished PhD dissertation, 1994).

Millet processing (also from Harvey and Fuller 2005).

Hulled vs. Free-threshing Cereals

Crops	**Hulled cereals (requiring dehusking)**	Free-threshing cereals
Wheats	Triticum monococcum Triticum diococcum	Triticum aestivum (including T. sphaerococcum) Triticum durum
Barley	Hordeum vulgare var. vulgare	Hordeum vulgare var. nudum
Rice	Oryza sativa	
Millets	Sorghum bicolor race bicolor S. bicolor race kafir	Sorghum bicolor race caudatum, race guinea, race durra
	Panicum miliaceum, P. sumatrense	Eleusine coracana
	Setaria italica, S. pumila, S. verticillata, etc.	Pennisetum glaucum (syn. P. americanum, P. typhoides)
	Brachiaria ramosa	
	Paspalum scrobiculatum	
	Echinochloa frumentacea	
	Digitaria spp.	

Tabular summary of pulse (legume) processing variables (from Fuller and Harvey 2006)

Modelprocess	**variant**	**pulse taxa**	**effects**	**remarks**
Havesting	uprooting	*Macrotyloma* (Watts 1908, 506); *Vigna radiata* (Watts 1908, 200)	incorporates weeds, especially climbers	
	cutting near base	*Lablab* (Watts 1908: 510); *Cajanus* (Westphal 1974; Van der Maeson 1989); *V. aconitifolia* (Voan Oerrs 1989a); *Macrotyloma* (Jansen 1989)	incorporates weeds, especially climbers	
	plucking pods	*Lablab* (Shrvashankar & Kulkarni 1989; Duke 1991); *Vigna radiata* (Watts 1908, 200; Weber 1991, 98)	selects against weeds	more likely in Neolithic due to uneven ripening. skip down to coarse sieving or pounding and rewinnowing
Threshing	free-threshing	*Lablab*, *Vigna*	frees pulses from pods and plants	some pods will not shatter, threshing of the by-product can be repeated one or more times to increase seed recovery
	pod-threshing	*Macrotyloma*, *Cajanus*,	separates pods from plant	in Cajanus leaves are stripped or separated by simple shaking
Winnowing and Raking	free-threshing types	*Lablab*, *Vigna*	separates light material including pod fragments: product includes pulse seeds, large and small weeds, pod pedicils(?)	skip pounding and rewinnowing (pod-threshing) step. By product may be used as fodder. If some pods are insufficiently broken, threshing may be repeated.
	pod-threshing types	*Macrotyloma*, *Cajanus*,	separates light material; product includes pods, large heavy weeds, headed weeds, stem pieces. Pulse seeds from broken pods may enter by-product	By-product may be used as fodder. Mature seeds may enter dung. Possible stored as pods after this step. Possibly stored as pods after this step
Coarse sieving	free-threshing types	*Lablab*, *Vigna*	removes plants stalk parts, weed heads. Will lose some pulse seeds, especially unshattered pods.	By-product may be used as fodder. Mature seeds may enter dung.
	pod-threshing types	*Macrotyloma*, *Cajanus*, some *Lablab*(?)	removes small and large weed seeds, pulse pods and weed heads remain (could be hand-picked)	
Fine Sieving	free-threshing types	*Lablab*, *Vigna*	removes remaining small weeds, chaff fragments Only weeds very similar in size and weight to pulse remain, possibly some pod pedicels (especially in *Vigna*). Will lose some small/immature pulse seeds.	store after this step as cleaned pulses: sieved again or hand-picked to remove remaining large weeds before cooking. Possible route to archaeological preservation.
	pod-threshing types	*Macrotyloma*, *Cajanus*		this step probably skipped
Pounding and rewinnowing	free-threshing types	this step unnecessary		
	pod-threshing types only	*Macrotyloma*, *Cajanus*, some *Lablab*(?)	removes pods, only some weed seeds or heads that are very close in size and wieght to pulse remain	possibly a daily routine processing: most likely route to archaeological preservation
Parching		parching or dry-rosting reported for *Vigna* spp., *M. uniflorum* (Watts 1908). *Lablab* reported to be 'dried' before storage (Shivashankar & Kulkarni 1989)	could lead to accidental charring and archaeological preservation	parched before grinding, or dry-roasting for consumption. Archaeological preservation route

Major publications in the development of archaeobotanical formation processes (for charred assemblages, especially from agricultural periods).

Körber-Grohne (1967, in German; 1981 in English [synoptic article]) discusses spatial distribution of archaeobotanical remains in relation structural features and potential processing and consumption activities.

Knörzer (1971, in German) observes that most charred assemblages includes cereals and herbaceous plant many of which are known field weeds. Thus most assemblages derive from arable ecosystems and weed species present can be used to infer aspects of agriculture. Also draws on Körber-Grohne's approach.

Dennell (1972) observes differences in composition of archaeobotanical assemblages between contexts, including the size of cereal grains. Carries out sieving experiments to confirm that past sieving of crops, as part of processing, may have contribute to the formation of distinct product/by-product assemblages. Subsequently, Dennell (1974; 1976) develops a general predictive model for comparison and interpretation of assemblages related to assumptions about the affecting of major crop processing stages on their composition. Hubbard (1976) disputes the statistical validity and assumptions of Dennell's model.

Hillman (1973) outlines need for ethnographic observation to produce generalisations that can be used to interpret archaeobotanical evidence

Hillman (1981; 1984) published crop-processing model on ethnographic work and turkey. Discusses its implication for interpreting archaeobotanical remains in terms of crop husbandry and producer/consumer sites.

G. Jones (1984; 1987) published similar processing sequence observed independently in Greece and discusses the potential of statistical analysis of weed seed types for distinguishing processing stages.

M. Jones (1985) applied elements of crop processing reasoning to question of distinguishing produce vs. consumer sites (but via method opposite Hillman 1981. See review in Van der Veen 1992). Also, a brief history of archaeobotanical interpretation in Europe.

Mikcesek (1987) general review article. Broad perspective but with less interest in crop processing, and a somewhat mistaken summary of early Dennell and Hillman work. Hastorf (1988) reviews importance of crop processing and highlights need for similar studies of New World crop species.

Boardman and Jones (1990) experimental charring demonstrating the much greater likelihood of chaff elements to be destroyed by charring, while grain are preserved, thus majorly biasing pre-charring ratios of chaff to grain.

Experimental work on processing, and charring maize reported by Goette, Williams, Johannessen and Hastorf (1994)

Reddy (1991; 1997; 2003) applies Hillman-Jones approach to Indian millets, with ethnographic and archaeological study.

Thompson (1996) applied Hillman-Jones approach to rice processing in Thailand

D'Andrea et al. (1999); Butler et al. (1999) preliminary report of ethnoarchaeological study of crop processing in Ethiopia, including tef and pulses.

Stevens (2003) develops the importance of routine processing (as the main source of waste) and considers how this allows contrasts to be interpreted in terms of labour mobilization. While recently Van Der Veen and Jones (2006) have critiqued this, they seem to have misunderstood Stevens and arrive at very nearly the same conclusion!

Application to phytolith analysis (for rice and millets) by Harvey and Fuller (2006)

A model of the variables in pulse processing, distinguishing pod-threshing and free-threshing pulse types (Fuller and Harvey 2006)

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