Screening for High Zinc Density Groundnut Genotypes in India

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INTRODUCTION

The groundnut (*Arachis hypogaea* L.) is an important legume food crop of India grown on about 8 million ha of land. Worldwide, there is a unique consumption in various forms, right from raw to value addition and fortification with less nutritive cereals and course grains. The shelled nuts, called seeds or kernels, are consumed after roasting, frying, salting or boiling and in many culinary preparations and confectionery products. The high-energy value, protein content, and minerals make groundnut a rich source of nutrition at a comparatively low price.

Zinc is an essential nutrient for human health. However, approximately two billion people are at risk of Zn deficiency worldwide and particularly in India, a fact that calls for a food-based solution to Zn malnutrition (Cakmak 2005, Welch 2005, WHO 2002, Singh 1999). In India, the consumption of 50-100 g of high Zn-density groundnut may be a solution to ensure an adequate level of Zn uptake. Thus, an effort was made to screen groundnut and to select genotypes with a high Zn density in their seeds for the consumption as food.

METHODS

A field experiment was conducted during a wet season at the National Research Centre for Groundnut in Junagadh, India. The soil was medium black, calcareous (19% $CaCO_3$) and clayey with a pH of 7.5 pH, 0.75% organic carbon, 780, 8.5, and 13 mg kg^{-1} of total N, available P (Olsen P), and heat soluble S (available S), respectively. The DTPA-extractable Fe, Mn, Zn, and Cu concentrations were 6.5, 4.5, 0.75 and 0.6 mg kg^{-1}, respectively, and the water-extractable B was 0.69 mg kg^{-1}. The field was prepared by ploughing and labelled, and 10 cm deep furrows were opened at 45 cm spacing in East-West direction. A basal dose of 40 kg N and 33 kg P ha^{-1} as di-ammonium phosphate and urea and 50 kg K ha^{-1} as muriate of potash were mixed into the soil before sowing, and 500 kg gypsum ha^{-1} were supplied at flowering.

Seventy groundnut genotypes, each in two row plots of 5 m length, were sown at 10 cm spacing with three replicates. The crop was grown under recommended practices, and appropriate care was taken to protect it from weeds, insects, pests, and diseases during the entire season. The crop was harvested at maturity, dried in the sun for a week, and the pod yield was recorded. The seed samples were analysed for Zn, Fe, Mn and Cu contents by Atomic Absorption Spectrophotometry (AAS), for Ca and Mg by titrimetry and for P by colorimetry.

The groundnut genotypes were sorted based on their Zn concentrations in seeds and categorized as low ($\leq$ 30 mg kg^{-1}), medium (31-50 mg kg^{-1}) and high ($\geq$ 51 mg kg^{-1} Zn) Zn-density genotypes.

RESULTS AND DISCUSSION

The Zn concentration in seeds of various groundnut genotypes ranged from 11 to 77 mg kg^{-1} Zn with a mean value of 45 mg kg^{-1} Zn in their seeds. Of 70 groundnut genotypes, seeds of seven genotypes had a low Zn density with less than 30 mg kg^{-1} Zn, and 34 genotypes had seeds with a medium Zn density of 31-50 mg kg^{-1} Zn. However, 19 genotypes with more than 50 mg kg^{-1} Zn in their seeds were categorized as high Zn-density genotypes. These high Zn-density genotypes including their pod yield and other nutrient contents are listed in table 1.

The data on various parameters indicated that seeds from most of the high Zn-density genotypes were also rich in P, Ca and Fe, which are also required in a daily diet. These high Zn-density groundnut genotypes should be used to ensure adequate level of Zn intake for normal child growth and human health. The yield of these genotypes ranged from 857 to 1527 kg ha^{-1} with GG 5 and ICGV 86590 being high-yielding commercial groundnut cultivars and good sources of Zn.

Table 1. High Zn density groundnut genotypes, their pod yield and macro- and micronutrient concentrations of seeds.

Groundnut Genotypes	Pod yield	Macro and micronutrient contents of seeds						
	kg ha^{-1}	Percent (%)			mg kg^{-1}			
		P	Ca	Mg	Fe	Mn	Zn	Cu
NRCG-4659	1273	0.79	0.13	0.33	283	45	77	25
PBS-14032	1247	0.66	0.27	0.31	293	49	76	27
NRCG-6820	1313	0.59	0.17	0.34	139	49	73	26
PM-20A	1207	0.49	0.18	0.27	253	48	70	22
PBS-14027	1220	0.43	0.12	0.29	156	49	67	27
NRCG-5513	1073	0.70	0.24	0.33	291	31	60	20
SP-144	1072	0.57	0.15	0.27	193	37	60	22
PBS-12042	1180	0.65	0.09	0.31	195	30	60	19
PM-79A	1047	0.73	0.17	0.32	297	26	59	21
ICGV-86590	1477	0.74	0.08	0.31	176	24	57	22
NRCG-1308	1260	0.62	0.19	0.32	329	40	56	21
NRCG-7472	1083	0.56	0.14	0.29	289	31	56	20
GG-5	1323	0.62	0.12	0.31	120	34	54	24
MOR-204	1230	0.55	0.16	0.32	199	29	54	19
PBS-12056	1503	0.62	0.27	0.32	271	32	53	22
NRCG-3498	1527	0.70	0.13	0.32	279	39	53	21
MOR-161	1123	0.73	0.19	0.32	294	29	52	21
PBS-20505	857	0.70	0.14	0.29	262	35	52	22
PBS-12074	1220	0.60	0.24	0.36	240	33	51	21

CONCLUSIONS

The identified high Zn-density groundnut genotypes are recommended for their cultivation and incorporation into human food to combat Zn malnutrition in India.

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