flowering and maturity the mutants were earlier than the parents. The observation was recorded from two hundred plants each. The mutant gives the same yield in 90 days as that of the parent variety in 107 days, which make it an economic mutant.

Table 1. Comparative morphological data on mutant and parent variety Prabhat DT

Characters	Mutant		Parent	
	Range	Mean	Range	Mean
Plant height (cm)	66-71	68.60	69-75	72.50
Number of branches	4-7	5.70	4-7	6.20
Days to flowering	46-49	47.20	58-60	58.60
Days to maturity	86-90	88.20	106-112	107.60
Number of pods per plant	75-90	78.00	72-84	78.60
Seeds per pod	2-5	3.10	2-5	3.20
Hundred seed weight (g)	7.2-7.8	7.32	7.1-7.6	7.33
Seed yield per plant	9.5-13.2	10.70	9.3-13.2	10.57
*Estimated yield in kg/ha	---	2379.99	---	2388.89

*Estimated yield was calculated by keeping the same plant population per hectare.

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GAMMA RAYS INDUCED BOLD SEEDED HIGH YIELDING MUTANT IN CHICKPEA

In pulses especially in chickpea (*Cicer arietinum* L.), genetic variability has been exhausted due to natural selection and hence conventional breeding methods are not very fruitful. Mutation techniques are the best methods to enlarge the genetically conditioned variability of a species within a short time and have played a significant role in the development of many crop varieties [2]. Investigations on the effects of ionizing radiations and chemical mutagens in induction of macro-mutations have received much attention owing to their utmost importance in plant breeding. The present study reports a bold seeded mutant in chickpea, the most dominating pulse crop on the Indian subcontinent.

Fresh seeds of chickpea variety 'Pusa-212' were procured from IARI, New Delhi and treated with different doses/concentrations of gamma rays (^{60}Co source at NBRI, Lucknow) and ethyl methanesulphonate (EMS), individually as well as in combination, to raise the M_1 generation. Seeds of M_1 plants were sown to raise M_2 plant progenies. A bold seeded mutant was isolated from 400 Gy gamma ray treatments. The mutant was confirmed as true bred, all the mutant seeds gave rise to morphologically similar plants in M_3, which were quite distinct from the control.

The bold seeded mutant showed "gigas" characteristics and vigorous growth. The plant remained initially straight but later on attained a trailing habit due to heavy secondary branching. The leaves, petioles, flowers, pods and seeds were almost double that of the parent variety, in size. The flowering occurred 10 days later than the parent and maturity was also delayed accordingly. Observations were recorded on various quantitative traits (Table 1). Plant height and number of primary branches showed a significant improvement over the parent. It is interesting to note that the number of pods and number of seeds per pod significantly decreased. However, the hundred seed weight (31.73 ± 0.59g) in the mutant plants was more than double in the parent variety (12.64 ± 0.14g). This ultimately resulted in an increase in the

overall yield of the mutant plant (38.86 ± 1.69g) as compared to Pusa-212 (30.05 ± 0.59g). Gamma ray induced bold seeded mutants have been reported earlier by different workers [1, 3]. The decrease in the number of seeds per pod and pods/plant and increase in seed weight is evidence of the fact that each trait is affected independently by the mutagenic treatment. Although the mutant was morphologically distinct, cytologically it was normal. There were 8 perfect bivalents at metaphase and the anaphase segregation was normal. It is concluded that bold seeded mutant may be utilized in various breeding programs as a donor parent for boldness character of the mutant. On the other hand the mutant may also itself be improved through crosses with other parents to accommodate more seeds in its large sized pod, which remained almost 50% empty.

Table 1. Seed yield and other agronomic traits of mutant and its parent variety (in brackets) in chickpea

Character	Mean±SE	Shift in mean	C.V. (%)
Plant height (cm)	61.66 ± 0.85	+ 2.45*	5.34
	(59.21 ± 0.71)	-	(4.67)
No. of branches/plant	7.46 ± 0.42	+ 1.73*	22.00
	(5.73 ± 0.28)	-	(19.19)
No. of pods/plant	124.33 ± 4.06	- 20.20*	12.65
	(144.53 ± 1.98)	-	(5.30)
No. of seeds/pod	1.35 ± 0.03	- 0.23*	8.33
	(1.58 ± 0.09)	-	(5.95)
100 seed weight (g)	31.73 ± 0.59	+ 19.09*	7.29
	(12.64 ± 0.14)	-	(4.40)
Plant yield (g)	38.86 ± 1.69	+ 8.81*	16.89
	(30.05 ± 0.59)	-	(7.64)

*Significant at 1%

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EVALUATION OF HIGH YIELDING MUNGBEAN MUTANTS

Mungbean is the second major (*Vigna radiata* (L.) Wilczek) pulse crop in Pakistan, after chickpea, and is the main pulse crop grown during the spring season in the province of Sindh. Its yield is very low (450 kg/ha) which is mainly due to the non-availability of pure seed of high yield potential genotypes. Keeping in view the importance of induced mutations in all field crops and particularly in the evolution of mungbean cultivars, an induced mutation programme was initiated at AEARC, Tandojam during 1985. Since then a large number of mutants have been developed and are at various stages of evaluation. Among them two mungbean mutants