

**A PUBLIC SAFETY STATEMENT FROM THE CENTRE FOR
FOOD SAFETY AND AGRICULTURAL RESEARCH (CEFSAR)**



Atrazine

(6-Chloro-N²-ethyl-N⁴-(propan-2-yl)-1,3,5-triazine-2,4-diamine) or
(1-Chloro-3-ethylamino-5-isopropylamino-2,4,6-triazine) or
(2-Chloro-4-ethylamino-6-isopropylamino-s-triazine) or
(6-Chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine) has been
one of the widely used herbicides in agriculture in Nigeria and Afrika in
general. It has been implicated in disrupting endocrine systems in
various species. Its mechanism of action as a puberty blocker and a sex

changer primarily involves its interference with hormonal pathways, particularly those regulating estrogen and androgen production.

1. Aromatase Induction: Atrazine has been found to upregulate the enzyme aromatase, which converts androgens (male hormones like testosterone) into estrogens (female hormones like estradiol). This mechanism leads to an imbalance in sex hormones, particularly in amphibians, where it has been linked to the feminization of males. Increased estrogen levels can cause males to develop female secondary sexual characteristics or interfere with normal male reproductive organ development. Studies, such as one by Hayes et al. (2002), have shown that atrazine exposure leads to hermaphroditism and feminization in amphibians like the African clawed frog (*Xenopus laevis*). Atrazine-induced aromatase activity leads to increased estrogen levels, contributing to the development of ovaries in genetically male frogs, effectively altering their sex.

2. Endocrine Disruption: Atrazine interferes with the hypothalamic-pituitary-gonadal (HPG) axis, a critical system that regulates reproductive function and sexual development. Atrazine inhibits the release of luteinizing hormone (LH) and follicle-stimulating hormone (FSH), which are necessary for the onset of puberty and sexual maturation in both males and females. Cooper et al. (2007) demonstrated that atrazine suppresses the secretion of LH in rats, delaying the onset of puberty in males. This suppression occurs through disruptions in the signaling pathways that regulate gonadotropin-releasing hormone (GnRH) in the brain, which is crucial for puberty initiation.

3. Alteration of Testosterone Levels: Atrazine reduces testosterone levels by affecting Leydig cells, which are responsible for testosterone production in males. This reduction in testosterone further delays puberty and can lead to the demasculinization of males. Lower testosterone levels have also been associated with the development of female traits in genetically male organisms. A study by Stoker et al. (2000) in rats found that exposure to atrazine reduced testosterone production, which delayed puberty in males and altered reproductive development.

NAFDAC'S POLICY ON THE BAN ON ATRAZINE

Atrazine is a pre-and post-emergence herbicide used in controlling annual grasses and broad-leaf weeds in crops such as maize, sorghum and sugarcane. Atrazine acts as a puberty blocker and a sex changer by interfering with hormonal pathways, particularly through inducing aromatase, disrupting the HPG axis, and reducing testosterone levels. These effects have been observed in both amphibians and mammals, making atrazine a significant endocrine disruptor that impacts reproductive development across species and causing cancers in mammals. This justifies the outright ban on the herbicide ATRAZINE by Nigeria's NAFDAC.

NAFDAC'S DIRECTIVE

Atrazine is a hazardous chemical banned in several countries. The effect of its residues on vegetables is one of the reasons for the rejection of farm produce like vegetables from the EU. Research shows that Atrazine has a highly toxic effect on humans, crops and the environment. It is the mandate of the NAFDAC to ensure safe and responsible use of agrochemicals by assuring only quality, effective and safe agrochemicals are registered by the Agency. Therefore, no importation, manufacture, distribution, sale, or use of bulk or retail pack size of any agrochemical with Atrazine will be accepted starting from 1st January 2025.

What is curious to us at the Centre for Food Safety and Agricultural Research (CEFSAR) is why postdate the effective date of the ban despite the verified toxicity and hazardous nature of this agrochemical called Atrazine?

References:

1. Hayes, T. B., Collins, A., Lee, M., Mendoza, M., Noriega, N., Stuart, A. A., & Vonk, A. (2002). "Hermaphroditic, demasculinized frogs after exposure to the herbicide atrazine at low ecologically relevant doses." *Proceedings of the National Academy of Sciences*, 99(8), 5476-5480. DOI: [10.1073/pnas.082121499](https://doi.org/10.1073/pnas.082121499).

- This study highlighted atrazine's role in inducing aromatase and causing hermaphroditism in frogs.

2. Cooper, R. L., Stoker, T. E., Tyrey, L., Goldman, J. M., & McElroy, W. K. (2007). "Atrazine disrupts the hypothalamic control of pituitary-ovarian function." *Toxicological Sciences*, 53(2), 297-307. DOI: [10.1093/toxsci/53.2.297](https://doi.org/10.1093/toxsci/53.2.297).

- This paper details how atrazine disrupts hormone regulation through its effects on the HPG axis, leading to delayed puberty.

3. Stoker, T. E., Guidici, D. L., Laws, S. C., & Cooper, R. L. (2000). "The effects of atrazine on puberty and thyroid function in the male Wistar rat." *Toxicological Sciences*, 58(1), 50-59. DOI: [10.1093/toxsci/58.1.50](https://doi.org/10.1093/toxsci/58.1.50).

- This study showed atrazine's effect on delaying puberty in male rats by reducing testosterone production.

Signed:

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