

Actions of plant hormones on shoot systems (stems and leaves):

Growth Substance (hormone)	Site of production and transport	Action in stems, leaves and buds
<b>Auxin (Indoleacetic acid, IAA)</b>	Apical meristems of shoots, roots and young leaves; fruits, pollen and developing seeds; <b>polar transport</b> (away from root tips and away from shoot tips) is by <b>diffusion</b> from cell to cell directed by <b>active transport across cell membranes</b>	Increases cell wall plasticity, allowing the cell wall to stretch & <b>growing cells to elongate</b> ; stimulates cell maturation; inhibits leaf abscission; <b>phototropism &amp; gravitropism</b> ; apical dominance
<b>Gibberellins (e.g. gibberellic acid)</b>	Young leaves, roots, fruits and developing seeds (developing endosperm); non-polar transport primarily in <b>phloem</b> , and less so in the xylem	<b>Stem elongation</b> in genetic dwarf plants; increases <b>internode growth</b> in sugarcane; induces <b>bolting in long-day plants</b> ; breaks bud dormancy
<b>Cytokinins</b> (e.g. zeatin, kinetin)	Root meristems, developing embryos, <b>crown gall</b> tissues; mainly transported in the <b>xylem</b> , and less so in the phloem	Stimulates <b>cell division</b> ; <b>morphogenesis</b> of roots, shoots and lateral buds; stimulates lateral bud development by breaking bud dormancy; <b>delays leaf senescence</b> ; stimulates light-induced synthesis of chlorophyll; induces crown gall and <b>witches broom</b> formation
<b>Absciscic acid (ABA)</b>	<b>Plastids</b> of most tissues, especially leaves and seeds; mainly transported in <b>phloem</b> , and less so in the xylem	Stimulates abscission of leaves; stimulates <b>bud dormancy</b> ; stimulates closure of stomata; inhibits auxin promoted growth; promotes senescence
<b>Ethene</b> (ethylene) gas	Synthesis in all parts of the plant; auxin stimulates ethene production; can be carried from plant to plant as an alarm signal	<b>Stress response</b> (e.g. to wounding) - stimulates stomatal closure under water stress; maintains bud dormancy; <b>inhibits growth</b> by blocking auxin action; stimulates leaf senescence and <b>abscission</b> ; stimulates sprouting of bulbs

Actions of plant hormones on root systems, fruit and seeds:

Growth Substance (hormone)	Action in roots	Action in flowers and fruit
<b>Auxin (Indoleacetic acid, IAA)</b>	Stimulates formation of lateral roots and roots at the bases of cut stems; inhibits primary root growth; gravitropism	Controls fruit abscission; stimulates ethene production; promotes fruit development (e.g. makes strawberries bigger)
<b>Gibberellins (e.g. gibberellic acid)</b>	?	Increases size of seedless grapes; delays senescence in citrus fruits; stimulates bolting & flowering in long day plants
<b>Cytokinins</b>	Morphogenesis of roots	?
<b>Absciscic acid (ABA)</b>	?	Stimulates fruit abscission
<b>Ethene (ethylene) gas</b>	?	Stimulates fruit ripening; stimulates flower senescence

Growth Substance (hormone)	Action in seeds	Commercial uses
<b>Auxin (Indoleacetic acid, IAA)</b>	Seeds produce auxin which stimulates fruit growth	Rooting powder; makes seedless fruit grow; herbicides – synthetic auxins kill broad-leaved plants
<b>Gibberellins (e.g. gibberellic acid)</b>	Breaks seed dormancy; stimulates the aleurone layer in grass seeds, to produce $\alpha$ -amylase to convert stored starch into maltose	Applied to crops to cause development of seedless fruits (without the need for fertilisation)
<b>Cytokinins (e.g. zeatin, kinetin)</b>	?	Stimulate axillary bud growth in orchard trees
<b>Absciscic acid (ABA)</b>	Stimulates seed dormancy	
<b>Ethene (ethylene) gas</b>	?	Controlled ripening of fruits (applied to crop so as to ripen all the fruit at the same time)