

➤ EACH OF THE CROPS HAS SPECIFIC AGROCLIMATIC DEMAND AT EACH OF THE GROWTH STAGES, WHICH IS DISCUSSED IN THIS TOPIC. HOWEVER, DISTRIBUTION OF METEOROLOGICAL PARAMETERS VARIES FROM PLACE TO PLACE, REGION TO REGION, WHICH IS SHOWN IN THE COMING SLIDES. THIS CAN HELPS US IN PROVIDING IDEA ABOUT CROP FITTING IN DIFFERENT AGROCLIMATIC ZONES.

- **AIM OF OPERATIONAL AGROMETEOROLOGY IS TO ADVISE THE USER COMMUNITY ON HOW BEST THEY CAN AVAIL ADVANTAGES OF METEOROLOGICAL PARAMETERS, FOR THEIR USE IN CROPS' GROWTH AND DEVELOPMENT AND FINALLY TO HARVEST THE OPTIMUM YIELD.**
- **ALL THE CROPS HAVE THEIR OWN SPECIFIC REQUIREMENT OF METEOROLOGICAL PARAMETERS AT EACH OF THEIR GROWTH STAGES. HENCE, THEY HAVE SELECTIVE RESPONSE TO THESE PARAMETERS. EXCESS OR DEFICIENCY OF THESE PARAMETERS DURING CROP GROWTH STAGES HAVE EFFECT ON THEM.**
- **THE CROPS ARE SOMETIMES INFLUENCED BY ONE OR TWO FACTORS, WHICH PLAY CRUCIAL ROLE AT SOME CRITICAL CROP GROWTH STAGES.**

- **EXPERIMENTS ON DIFFERENT DATES OF SOWING CAN PROVIDE USEFUL INDICATION OF THE CLIMATIC REQUIREMENTS AS THEY ARE ACCOMPANIED BY DAILY METEOROLOGICAL OBSERVATIONS, PHENOLOGICAL OBSERVATIONS AND BIOMETRIC DATA ON CROP.**
- **IN THE PRESENT SCENARIO, TOWARDS BETTER AGROMETEOROLOGICAL ADVISORY SERVICES, SOME TIPS ON AGROCLIMATOLOGY OF IMPORTANT CROPS, BASED ON CROP WEATHER RELATIONSHIP STUDY, IS ESSENTIALLY REQUIRED FOR BETTER CROP FITTING IN SUITABLE ZONE.**

- **HERE, AN ATTEMPT HAS BEEN MADE TO HIGHLIGHT THE CROP WEATHER RELATIONSHIP OF SOME KEY FOOD, FIBRE, SUGAR, OILSEED, PULSE AND CASH CROPS. THE PRESENT APPROACH IS BASICALLY A 'REVIEW OF LITERATURE' TYPE IN WHICH SALIENT FEATURES OF AVAILABLE FINDINGS HAVE BEEN PRESENTED. THESE WILL GIVE AN IDEA ABOUT TIME OF ISSUANCE OF ADVISORIES FOR THE SPECIFIC CROP IN ITS LIFE SPAN.**

# RICE

- IT IS A SEMI AQUATIC PLANT AND HENCE, ITS WATER REQUIREMENT IS VERY HIGH. RICE CAN BE GROWN IN *PRE - KHARIF*, *KHARIF*, AS WELL AS IN *RABI* SEASONS PROVING ITS WIDER ADAPTABILITY TO VARIED CLIMATIC CONDITIONS.
- 20 - 36<sup>0</sup>C AVERAGE DAY TEMPERATURE WITH NIGHT TEMPERATURE 20 -23<sup>0</sup>C ARE IDEAL FOR ITS GROWTH.
- THE CROP CAN TOLERATE 19<sup>0</sup>C TO 40<sup>0</sup>C THE OPTIMUM TEMPERATURE REQUIRED FOR GERMINATION IS AT LEAST 10<sup>0</sup> C; FOR FLOWERING IS 22-23<sup>0</sup>C AND FOR GRAIN FORMATION IS 20-21<sup>0</sup>C.
- A MEAN AIR TEMPERATURE OF AROUND 22<sup>0</sup>C IS REQUIRED FOR THE ENTIRE GROWTH. VERY HIGH TEMPERATURES ALONGWITH HIGH WIND SPEED CAUSE SUN BURNING AND SCALD DISEASES. LOW TEMPERATURE REDUCES FORMATION OF SPIKELETS, GERMINATION, SEEDLING DEVELOPMENT, TILLERING AND SHOOT HEIGHT.

- **SOIL TEMPERATURE ABOVE 16°C AFTER TRANSPLANTING IS VERY ESSENTIAL. LIGHT INTENSITY UPTO 200% OF NORMAL GIVES MORE TILLERS, PANICLES AND WELL DEVELOPED GRAINS.**
- **HIGHER RH (%) WITHIN THE CROP CANOPY IS USUALLY CONDUCTIVE.**
- **FOR OBTAINING THE MAXIMUM YIELD THE ACCUMULATED SUNSHINE HOURS DURING THE CROP SPAN OF RICE IS 1000 WITH 220 - 240 HOURS IN THE LAST 30 DAYS.**
- **RICE HAS VERY HIGH WATER REQUIREMENT. OPTIMUM WELL DISTRIBUTED RAINFALL DURING ITS ALMOST 4 MONTHS GROWING PERIOD IS 1120 TO 1500 MM. STANDING WATER FROM END OF TILLERING TO GRAIN RIPENING IS USEFUL. THE CROP IS HIGHLY SENSITIVE TO WATER DEFICIENCY AT FLOWERING AND HEADING STAGES.**

- **TOTAL WATER REQUIREMENT OF THE CROP VARIES FROM 80 TO 180 CM DEPENDING UPON CROP VARIETY, LOCAL CLIMATE, GROWING SEASON AND SOIL TYPE.**
- **IN *KHARIF* SEASON, WHEN HUMIDITY IS HIGH AND EVAPORATIVE DEMANDS ARE LOW, MAINTENANCE OF CONTINUOUS SUBMERGENCE IS NOT ESSENTIAL BUT DURING *RABI* SEASON IT IS REQUIRED. GREAT ECONOMY IN WATER USE BY RICE CROP CAN BE ACHIEVED IF SUITABLE MEASURES ARE ADOPTED TO REDUCE THE DEEP PERCOLATION LOSSES, BY SUITABLE IRRIGATION TECHNIQUES.**

**AVG. D.TEMP. 20-36° C  
N.TEMP. 20 -23°C,  
TOLERABLE TEMP. 19-  
40°C**

**OPT. TEMP.  
>16°C (TRANSP.) ;  
22-23°C (FLOWERING) ;  
20-21°C (GRAIN FORM.)  
MEAN AIR TEMP. 22°C**

**LIGHT INTENSITY ≤  
200% OF NORMAL  
FOR MORE TILLER  
PANICLES HIGHER  
RH**

**RICE**

**OPT. RF 1120 TO  
1500MM, VERY  
HIGH WATER REQ.  
WR : 80 TO 180CM**

**ACCUMULATED  
SSH : 1000 WITH  
220-240 HRS IN  
LAST 30 DAYS**

**CAN GROW IN ANY OF  
THE SEASONS VIZ.  
PRE-KHARIF, KHARIF,  
RABI**



# WHEAT

- THE BEST ADAPTATION OF THE CROP IS IN AREAS WITH MODERATE TEMPERATURE AND SUB- HUMID TO SEMI-ARID CONDITIONS.
- ENVIRONMENTAL CONDITIONS CAUSE WIDE FLUCTUATIONS IN EMERGENCE, GROWTH, GRAIN DEVELOPMENT, RIPENING AND NUTRITIONAL QUALITY OF THE CROP.
- WHEAT IS BASICALLY A TEMPERATE CLIMATE PLANT, GROWN IN THE SUMMER SEASON IN TEMPERATE REGION AND WINTER OR *RABI* SEASON IN THE SUB - TROPICS.
- A MEAN DAILY TEMPERATURE OF 15 TO 20<sup>0</sup>C IS THE OPTIMUM FOR ITS GROWTH AND DEVELOPMENT.

- **HIGHER TEMPERATURES OF ABOUT 30 - 35°C HAVE IN GENERAL DETRIMENTAL EFFECT TO THE CROP PERFORMANCE. THE CROP CAN WITHSTAND INTENSE COLD CONDITION. THE OPTIMAL RANGE OF TEMPERATURE FOR THE GERMINATION OF WINTER WHEAT AND FOR ITS VEGETATIVE GROWTH IS 15 TO 20°C .**
- **MINIMUM, OPTIMUM AND MAXIMUM CARDINAL TEMPERATURES FOR GERMINATION OF WHEAT CROP ARE 3 TO 4.5°C, AROUND 25°C AND 30- 32°C, RESPECTIVELY. HIGH TEMPERATURE DURING RAPID GROWTH AND TILLERING PERIODS RESULTS IN POOR TILLERING, LOW NUMBER OF EFFECTIVE TILLERS, POOR GROWTH RATE, SHORT SHOOT HEIGHT, LOW LAI, SHORT EARS WITH LOWER NUMBER OF SPIKELETS, LOWER FERTILIZATION, LOWER GRAIN WEIGHT AND LOWER QUALITY.**

- **HIGH SOIL MOISTURE CONTENT IS USEFUL FOR HIGH GERMINATION, GOOD START OF SEEDLINGS, GOOD SEED SETTING AND DEVELOPMENT.**
- **THE CROP SHOWS RESISTANCE TO DROUGHT THOUGH IT IS HIGHLY SENSITIVE TO MOISTURE STRESS DURING THE PERIOD FROM SHOOTING TO ADVANCED HEADING STAGES.**
- **BRIGHT SUNNY DAYS WITH DRYNESS AND COOLER NIGHTS DURING RIPENING PERIOD GIVE BETTER SIZED QUALITY GRAINS.**
- **OPTIMUM RAINFALL REQUIREMENT IS 50-87.5 CM DURING THE GROWING SEASON AND THE TOTAL WATER REQUIREMENT IS 45-55 CM FOR DIFFERENT VARIETIES AND SEASONAL CONDITIONS. DAILY CU VARIES FROM 0.17 TO 0.87 CM FROM EMERGENCE TO GRAIN FILLING, THE HIGH RANGE BEING 0.62CM FOR THE PERIOD FROM BOOT TO DOUGH STAGES.**

- **THE INFORMATION ON THE CRITICAL GROWTH STAGES IN AREAS WITH LIMITED WATER SUPPLY IS USEFUL.**
- **A DELAY IN SOWING TO AVAIL THE MAXIMUM ADVANTAGE OF COOL WEATHER LEADS TO POOR CROP STANDS ON ACCOUNT OF DECREASING SOIL MOISTURE.**

**AVG. D.TEMP. 15-20° C  
TOLERABLE TEMP. 30-35°C  
HIGH TEMP. AFFECTS ALL  
GROWTH & YIELD CHARAC**

**OPT. TEMP. 15-20°C  
(VEGETATIVE) ;  
TMIN : 3 - 4.5°C  
OPT.TEMP. :25°C  
TMAX : 30-32°C**

**DAILY CU : 0.17 TO  
0.87 CM FROM  
EMERGENCE TO  
GRAIN FORM**

**WHEAT**

**OPT. RF 50 TO  
87.5CM  
WR : 45 TO 55CM**

**HIGHEST CU  
DEMAND BOOT TO  
DOUGH STAGE**

**CAN GROW IN RABI  
SEASON, SUB  
HUMID TO SEMI  
ARID CONDITION**

# MAIZE

- IT IS ESSENTIALLY A WARM AND HUMID REGION CROP AND GROWS WELL IN AREAS OF MODERATE CLIMATE THROUGHOUT THE YEAR.
- MAIZE GROWS WELL IN AREAS WHERE THE MEAN TEMPERATURE IS AROUND 24°C AND NIGHT TEMPERATURE IS ABOVE 15°C.
- NO MAIZE CULTIVATION IS POSSIBLE IN AREAS WHERE MEAN SUMMER TEMPERATURE IS BELOW 19°C OR WHERE AVERAGE NIGHT TEMPERATURE DURING THE THREE SUMMER MONTHS FALLS BELOW 21°C. HIGH NIGHT TEMPERATURES ALSO RESULT IN LESS YIELD.

- **DURING THE FLOWERING PERIOD IF THE MAXIMUM TEMPERATURE IS AROUND 35°C OR MORE, THE FERTILIZATION WILL BE HAMPERED AND AS A RESULT YIELD WILL BE POOR.**
- **MAIZE IS ADAPTED TO HUMID CLIMATE AND HAS MODERATE TO HIGH WATER REQUIREMENT DEPENDING UPON TYPE OF SOIL, SEASON. IT REQUIRES 50-75 CM OF RAINFALL.**
- **THE CROP REQUIRES HIGH AMOUNT OF WATER DURING ITS INFLORESCENCE.**
- **MAIZE IS VERY SENSITIVE TO EXCESS WATER AND HENCE IT IS DESIRABLE TO PLANT IT ON RIDGES.**
- **ALSO, BEING PARTIALLY RESISTANT TO DROUGHT IT CAN ESCAPE EARLY SEASON DROUGHT.**

**AVG. TEMP. 24° C N. TEMP.  
>15°C, NO MAIZE IF MEAN  
SUMMER TEMP  
<19°C&N.TEMP. < 21°C**

**MAX. TEMP.  
>35°C  
(HARMFUL.) ;**

**MAIZE**

**OPT. RF 50 TO  
75CM**

**SENSITIVE TO  
EXCESS WATER**

**RESISTANT TO  
DROUGHT**



# JOWAR OR SORGHUM

- IT GROWS WELL IN DRYLANDS UNDER ERRATIC RAINFALL CONDITION.
- JOWAR CAN TOLERATE HOT, DRY AND SUNNY CLIMATE. A TEMPERATURE RANGE OF 15 - 41<sup>0</sup>C WITH THE OPTIMUM BEING 25 - 32<sup>0</sup>C IS CONDUCIVE FOR THE CROP GROWTH. THE CROP CAN TOLERATE TEMPERATURE WELL ABOVE 50<sup>0</sup>C FOR A LONG PERIOD.
- THE MINIMUM TEMPERATURE FOR ITS GERMINATION IS 7-10<sup>0</sup>C, WHILE OPTIMUM BEING 18-21<sup>0</sup>C. DAY TEMPERATURE HIGHER THAN 21<sup>0</sup>C IN THE FIRST MONTH AND 27<sup>0</sup>C THEREAFTER HASTENS MATURITY.
- ITS ROOTS ARE MUCH MORE SENSITIVE THAN SHOOTS TO HIGH TEMPERATURE. IT IS SENSITIVE TO LOW TEMPERATURE DURING GERMINATION, EARLY GROWTH AND GRAIN FORMATION STAGES. THE MINIMUM EMERGENCE TEMPERATURE IS 8<sup>0</sup>C.

- **THE CROP IS 'CAMEL' IN CROP WORLD BECAUSE OF ITS TOLERANCE TO FAIRLY HIGH TEMPERATURE WITH LOW SOIL MOISTURE REQUIREMENT.**
- **A WELL DISTRIBUTED RAINFALL OF 50-75CM UPTO THE HEADING STAGE IS CONDUCIVE. ERRATIC, HEAVY RAINS CREATING WATER LOGGING FOR A LONGER PERIOD IS UNDESIRABLE THOUGH THE CROP CAN TOLERATE FLOODED CONDITION, PARTIALLY.**
- **TOTAL WATER REQUIREMENT IS AROUND 40-65 CM.**
- **HIGH SOIL MOISTURE AT SOWING GIVES POOR EMERGENCE. DEEP LOAMY SOILS ARE VERY SUITABLE FOR THE CROP. LONG NIGHTS REDUCES TILLERING AND HASTENS FLORAL INITIATION.**

**TOLERABLE TEMP. 15-41°C**  
**OPT. TEMP. 25°C – 32°C**

**OPT. TEMP.**  
**>18-21°C(GERMINATION.) ;**  
**DAY TEMP. > 21°C IN FIRST**  
**MONTH & THEN 27°C**  
**AFTERWARDS HASTENS**  
**MATURITY**

**JOWAR**

**CAMEL IN CROP**  
**WORLD**

**OPT. RF 50 TO**  
**75CM**  
**WR : 40 TO 65CM**

**HIGH SOIL**  
**MOISTURE GIVES**  
**POOR**  
**EMERGENCE**

# COTTON

- THE CROP IS HEAT LOVING PLANT AND IS SENSITIVE TO TEMPERATURE AND SOIL WATER CONDITIONS.
- COOL NIGHTS AND LOW DAY TIME TEMPERATURE ENCOURAGE MUCH VEGETATIVE GROWTH. THE CROP REQUIRES ABUNDANT SUNSHINE WITH ADEQUATE MOISTURE, FAIRLY HIGH TEMPERATURE AND AROUND 200 DAYS FROST FREE PERIOD.
- TEMPERATURE BELOW 18<sup>0</sup>C RETARDS GERMINATION. A MEAN ANNUAL TEMPERATURE WELL OVER 16<sup>0</sup>C IS ESSENTIAL FOR HIGH YIELDS AND TEMPERATURES ABOVE 39<sup>0</sup>C IS DETRIMENTAL TO THE CROP GROWTH. NIGHT TEMPERATURE OF 18-21<sup>0</sup>C LEADS TO GOOD BRANCH DEVELOPMENT. TEMPERATURE BELOW 21<sup>0</sup>C ARE NOT CONDUCIVE FOR PROPER FLOWER BUD INITIATION.

- **AFTER EMERGENCE THE SOIL MOISTURE SHOULD NOT FALL. BRIGHT SUNNY DAYS AFTER EMERGENCE ARE UNDESIRABLE IN EARLY STAGES.**
- **CLOUDINESS PROLONGS THE VEGETATIVE GROWTH. DURING LATER BOLL DEVELOPMENT PERIOD LOW NIGHT TEMPERATURES RESULTS IN SHORTER FIBRES AND BAD BOLL OPENING. THE OVERALL DEVELOPMENT RATE IS MAXIMIZED AT A TEMPERATURE RANGE OF 25 TO 30°C.**

- **THE MINIMUM RAINFALL LIMIT FOR COTTON IS 50 TO 65 CM. HEAVY RAINFALL DURING SOWING AND AT EARLY STAGES ARE UNDESIRABLE. EXCESSIVE RAINFALL AT LATER STAGES MAY CAUSE THE SHEDDING OF LEAVES, BLOOMS AND BOLLS.**
- **THE CROP HAS A DEEP AND EXTENSIVE ROOT SYSTEM. NATURALLY, ITS WATER NEED IS VERY HIGH.**
- **TOTAL WATER REQUIREMENT OF THE CROP VARIES FROM 70- 110CM. PEAK DAILY WATER USE RATE IS 0.35 INCH.**

**AVG. ANNUAL TEMP.  
>16°C N. TEMP. 18-21°C,  
TOLERABLE TEMP. 16-  
39°C**

**OPT. TEMP.  
>21°C (FLORAL BUD  
INITIATION) ;  
25-30°C (MAXIMIZED  
DEVELOPMENT) ;**

**COTTON**

**EXCESSIVE  
RAINFALL AT  
LATER STAGE IS  
HARMFUL**

**MIN. RF 50 TO 65CM  
WR : 70 TO 110CM  
PEAK DAILY 0.35  
INCH**

# JUTE

- IT IS A CROP OF THE HUMID MONSOON CLIMATE. GROWTH OF JUTE IS FAVOURED BY HUMID AND WARM TO HOT WEATHER.
- IN JUTE GROWING BELT, THE MAXIMUM TEMPERATURE IS NOT MORE THAN 43°C, THE MINIMUM TEMPERATURE IS ABOVE 15°C WITH R.H.% NEVER BELOW 65%.
- AROUND 100-120 CM WELL DISTRIBUTED RAINFALL WITH BRIGHT SUNSHINE IS CONDUCIVE FOR ITS GROWTH. A TEMPERATURE RANGE OF 27-35°C WITH R.H.% MORE THAN 80% IS GOOD FOR THE CROP GROWTH.



- **THE CROP AT SEEDLING STAGE CAN NOT WITHSTAND WATER LOGGING.**
- **THE CROP IS A SHORT DAY PLANT. *C. OLITORIUS* IS MORE SENSITIVE TO SHORT DAY CONDITION. UNDER HIGH TEMPERATURE(AT AROUND 32<sup>0</sup>C) THE CROP HEIGHT AS WELL AS BASAL DIAMETER INCREASES.**

**RH > 65%**

**IDEAL TEMP.  
RANGE 27 TO 35°C**

**MAX. TEMP.  
≤ 43°C ;  
MIN TEMP. > 15°C**

**CANNOT  
WITHSTAND  
WATER LOGGING**

**JUTE**

**OPT. RF 100 TO 120CM  
WITHOUT STAGNATION  
WR : AROUND 40 – 50  
CM**

**HUMID, WARM TO  
HOT WEATHER  
IDEAL**

# SUGARCANE

- SUGARCANE IS A TROPICAL CROP AND REQUIRES WARM HUMID CLIMATE FOR ITS GROWTH. AS IT GROWS THE YEAR ROUND, IT PASSES THROUGH ALL TYPES OF WEATHER AND SEASONAL CONDITIONS.
- FOR GOOD SPROUTING, THE SETTS REQUIRE THE MEAN DAILY TEMPERATURE OF AROUND 22<sup>0</sup>C (30<sup>0</sup>C BEING THE BEST). THE OPTIMUM RANGE IS FROM 27-38<sup>0</sup>C; TEMPERATURE BEYOND 38<sup>0</sup>C IS NOT CONDUCTIVE. SOIL TEMPERATURE OF 27-28<sup>0</sup>C IS OPTIMUM FOR THE PLANT GROWTH. THE MAXIMUM TEMPERATURE ABOVE 37<sup>0</sup>C INHIBITS GROWTH. ADEQUATE WARMTH AND PLENTY OF MODERATE LIGHT NEAR THE BASE OF YOUNG SHOOTS ARE ESSENTIAL TO INDUCE EARLY TILLERING.
- NIGHT TIME TEMPERATURE HAS A CRUCIAL ROLE IN CANE GROWTH. WEAK LIGHT REDUCES ITS GROWTH.

- **MOIST HUMID CLIMATE (RH ABOVE 70%) WITH 20-32°C TEMPERATURE RANGE, LONG DAYS, SHORT NIGHTS AND AMPLE WATER SUPPLIES ARE HIGHLY CONDUCTIVE TO GOOD VEGETATIVE GROWTH. LOW MINIMUM TEMPERATURES RETARD FLOWERING AND VERY LOW TEMPERATURES REDUCES QUALITY OF JUICE.**
- **THE CROP YIELD IS REDUCED TO ONE-HALF IF THE SUNSHINE IS CUT DOWN TO HALF THE NORMAL.**
- **THE CROP REQUIRES 125 TO 165 CM OF RAINFALL IN A YEAR. THE CROP HAS AN EXTENSIVE FIBROUS ROOT SYSTEM.**
- **THE OPTIMUM YIELDS OF SUGARCANE ARE OBTAINED BY MAINTAINING A VERY HIGH MOISTURE LEVEL THROUGHOUT THE ROOT ZONE DURING THE ENTIRE GROWING SEASON.**
- **THE TOTAL WATER REQUIREMENT OF THE CROP VARIES BETWEEN 70-85 ACRE-INCHES ANNUALLY.**

**AVG. D.TEMP. 22-36° C  
N.TEMP. 20 -23°C,  
TOLERABLE TEMP. <  
38°C**

**OPT. TEMP.  
27-38°C ;  
SOIL TEMP. 27-28°C**

**SUGARCANE**

**MOIST HUMID CLIMATE  
(RH MORE THAN 70% )  
WITH 20 TO 32°C IDEAL**

**OPT. RF 125 TO 165  
CM A YEAR  
WR : 70 TO 85 ACRE -  
INCHES**

# GRAM

- SUFFICIENTLY COOL AND HUMID CLIMATE IS IDEAL FOR GRAM CULTIVATION.
- THE SEEDS OF THE CROP CAN GERMINATE FROM 10 TO 45<sup>0</sup>C.
- TEMPERATURE AROUND 15-20<sup>0</sup>C IS OPTIMUM FOR ITS GROWTH. THE ROOT ZONE SOIL TEMPERATURE OF 15-25<sup>0</sup>C IS HIGHLY BENEFICIAL FOR EARLY AND ADEQUATE NODULATION. NODULATION IS ADVERSELY AFFECTED WHEN THE ROOT TEMPERATURE EXCEEDS 30<sup>0</sup>C.

- **EXCESSIVE RAIN AFTER SOWING AND AT FLOWERING ARE HARMFUL.**
- **EXCESS ATMOSPHERIC HUMIDITY APPEARS TO HAVE NEGATIVE INFLUENCE ON SEED SETTING.**
- **THE HIGHEST POD FORMATION HAS BEEN RECORDED AT RELATIVE HUMIDITY RANGING FROM 20-40%.**
- **AGAIN, EXTREMELY LOW ATMOSPHERIC HUMIDITY AT FLOWERING AND POD FORMATION STAGES RESULTS IN REDUCED YIELD.**

GRM.TEMP. 10-45° C  
OPT.TEMP. 15 -20°C,

SOIL TEMP. 15 - 25°C  
MODULATION  
AFFECTED IF ROT  
TEMP. >30°C

**GRAM**

RH 20 -40%  
(HIGHEST POD  
FORMATION)

WR : 25 TO 30CM

EXCESSIVE RF.  
HARMFUL



## **ARHAR OR PIGEON -PEA**

- **THE CROP IS HIGHLY HEAT AND DROUGHT RESISTANT BUT SUSCEPTIBLE TO FROST , SALINITY AND WATER-LOGGING.**
- **IT IS LESS RESPONSIVE TO IRRIGATION. TEMPERATURE AROUND 25<sup>0</sup>C IS CONDUCIVE FOR ITS GROWTH. THE CROP WATER REQUIREMENT IS AROUND 40-50 CM. MOST OF ITS EARLY AND MEDIUM VARIETIES ARE PHOTO-INSENSITIVE.**

**HIGH HEAT &  
DROUGHT RESISTANT**

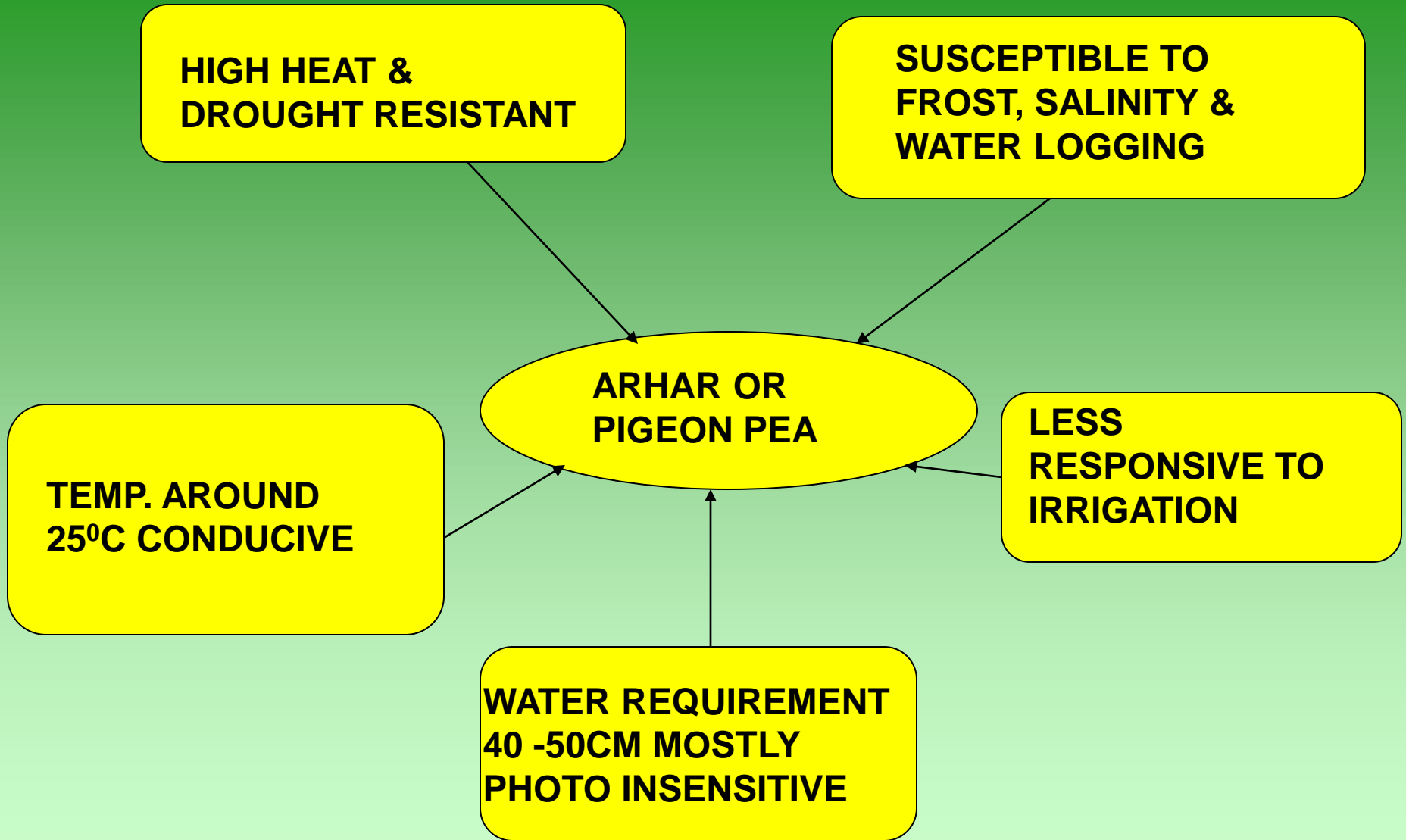
**SUSCEPTIBLE TO  
FROST, SALINITY &  
WATER LOGGING**

**ARHAR OR  
PIGEON PEA**

**TEMP. AROUND  
25°C CONDUCIVE**

**LESS  
RESPONSIVE TO  
IRRIGATION**

**WATER REQUIREMENT  
40 -50CM MOSTLY  
PHOTO INSENSITIVE**



# SOYBEAN

- IT IS A CROP OF WARM, HUMID TEMPERATE REGION.
- ITS CULTIVATION HAS NOW EXTENDED TO SEMI-ARID TROPICS WITH DAILY MAXIMUM TEMPERATURES BELOW 40°C AND FAIRLY ASSURED RAINFALL CONDITIONS DUE TO AVAILABILITY OF DIFFERENT VARIETIES.
- THE OPTIMUM TEMPERATURE FOR ITS SEED GERMINATION IS 30°C.
- THE FREEZING TEMPERATURE CAN RESULTS IN COMPLETE DESTRUCTION OF THE LEAVES. THE HIGH TEMPERATURE DURING FLOWERING AND RIPENING INCREASES FAT, BUT REDUCES PROTEINS.

- FLOWER INITIATION IS MAXIMUM WITH DAY TEMPERATURE OF 25-29<sup>0</sup>C AND NIGHT TEMPERATURE OF 19-22<sup>0</sup>C. FOR POD FORMATION A TEMPERATURE RANGE OF 16-26<sup>0</sup>C IS OPTIMUM WITH 70 -75% R.H.
- NODULATION AND NITROGEN FIXATION IN SOYBEANS ARE GREATLY AFFECTED BY SOIL TEMPERATURE. SOYBEAN GROWTH IS LIMITED BY TEMPERATURE IN EXCESS OF 33<sup>0</sup>C.
- THE SEASONAL CROP WATER REQUIREMENT VARIES BETWEEN 45-75 CM, WITH 0.75CM/DAY AS THE PEAK NEED DURING ACTIVE GROWTH, FLOWERING AND POD DEVELOPMENT PERIOD. THE CROP IS SENSITIVE TO WATER LOGGING.
- DROUGHT DURING FLOWERING, POD SETTING AND EARLY DEVELOPMENT CAUSES SEVERE POD SHEDDING. YIELD OF SOYBEAN IS ADVERSELY AFFECTED BY MOISTURE STRESS DURING THE POD FILLING PERIOD AND MAY RESULT IN 20-50% REDUCTION IN GRAIN YIELDS.

D.MAX. TEMP.< 40° C  
D.TEMP. 25 -29°C  
(FLOWERING) ,  
NIGHT TEMP. 19-22°C  
(FLOWERING)

OPT. TEMP. 30°C (SEED  
GRM.);  
TEMP. 16-26°C WITH 70-  
75% RH OPT. FOR POD  
FORMATION (

**SOYBEAN**

LIMITED GROWTH >  
33°C NODULATION  
AFFECTED BY SOIL  
TEMP.

WR : 45 TO 75MM  
PEAK NEED  
0.75CM/DAY

SENSITIVE TO WATER  
LOGGING  
MOISTURE STRESS AT  
GRAIN FILLING  
AFFECTS YIELD

## **GROUNDNUT**

- **IT IS NORMALLY A WARM AND MODERATELY MOIST CLIMATE CROP REQUIRING ABUNDANT SUNSHINE AND MODERATE RAINFALL.**
- **A LONGER SEASON WITH MOIST SOIL CONDITIONS FROM FLOWERING TO POD DEVELOPMENT, WARM CLIMATE (24-34°C TEMPERATURE), PLENTY OF SUNSHINE ARE HIGHLY FAVOURABLE FOR THE CROP.**
- **TEMPERATURE ABOVE 44°C AND BELOW 4°C ARE NOT DESIRABLE. THE OPTIMUM SEED GERMINATING TEMPERATURE IS 14-16°C. LOW TEMPERATURES RETARD GERMINATION OF SEEDS, GROWTH OF PLANTS AND LENGTHEN FLOWERING, WHILE HIGHER TEMPERATURE RESULTS IN THE BEST PERFORMANCE OF THE STEM GROWTH, NUMBER OF FLOWERS AND NUMBER OF PODS.**

- **THE MAXIMUM NUMBER OF PODS HAVE BEEN HARVESTED AT A MEAN SOIL TEMPERATURE OF 23<sup>0</sup>C. THE NUMBER OF PODS DECREASE AS THE SOIL TEMPERATURE INCREASES. IT IS AN EFFICIENT INTERCEPTOR OF SOLAR RADIATION.**
- **A WELL DISTRIBUTED RAINFALL OF 50-70 CM IS GENERALLY ADEQUATE FOR THE CROP. THE CROP REQUIRES DRY CONDITIONS FOR POD MATURITY, HARVESTING AND ONLY MOIST SOIL AFTER EMERGENCE TILL FLOWERING STARTS.**
- **RAIN AT MATURITY REDUCES YIELD. MOIST SOIL CONDITIONS AT THE PEGGING AND EARLY POD DEVELOPMENT IS HIGHLY CRITICAL.**
  
- **HIGH ATMOSPHERIC HUMIDITY STIMULATES GREATER RATES OF FLOWERING, RESULTING IN INCREASED PEG SETTING.**
- **DURING THE VEGETATIVE PERIOD THE SOIL MOISTURE STRESS DELAYS FLOWERING, FRUIT SETTING AND ULTIMATELY RESULTS IN POOR YIELD.**

**D.TEMP. < 44° C  
MIN.TEMP. < 4° C,  
AVG. TEMP. 24-34° C**

**OPT. TEMP. 14-16° C (GRM.);  
MEAN SOIL TEMP. 23° C  
(FOR MAX. POD)**

**GROUNDNUT**

**RAIN AT  
MATURITY  
HARMFUL**

**OPT. RF 50 TO  
70MM  
WR : 40 TO 50CM**

**SOIL MOISTURE  
STRESS AFFECTS  
FLOWERING, FRUIT  
SETTING & YIELD**



# MUSTARD

- **MUSTARD IS A CROP OF SUBTROPICAL AND TEMPERATE CLIMATE. COOL TEMPERATURE AND FAIRLY GOOD MOISTURE DURING THE CROP GROWING PERIOD AND A DRY HARVEST PERIOD IS IDEAL FOR THE CROP.**
- **HIGH TEMPERATURE AND ABSENCE OF RAIN DURING FLOWERING PERIODS DECREASE SEED YIELDS.**
- **HEAVY RAINFALL DURING SEED GERMINATION AFFECTS GERMINATION AND SEEDLING ESTABLISHMENT. THE CROP PRODUCES THE BEST RESULT IN AREAS WHERE RAINFALL DURING THE GROWTH PERIOD IS 15-20 CM.**

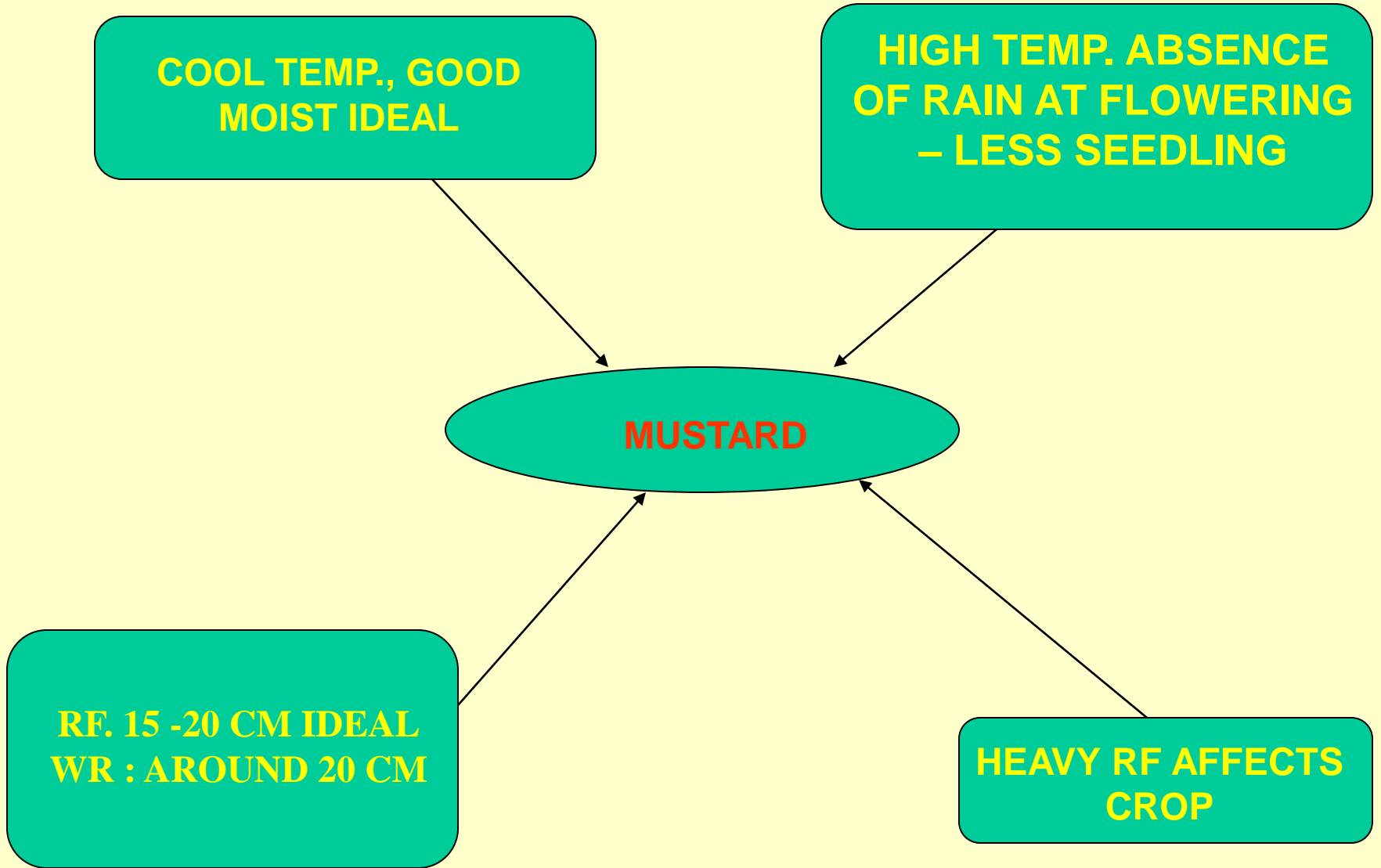
**COOL TEMP., GOOD  
MOIST IDEAL**

**HIGH TEMP. ABSENCE  
OF RAIN AT FLOWERING  
– LESS SEEDLING**

**MUSTARD**

**RF. 15 -20 CM IDEAL  
WR : AROUND 20 CM**

**HEAVY RF AFFECTS  
CROP**



# SUNFLOWER

- **IT IS VERY DROUGHT TOLERANT PLANT, GROWN IN COOL TEMPERATE REGION.**
- **THE CROP IS FAIRLY TOLERANT TO BOTH HEAT AND COLD, BUT VERY EXTREMES OF TEMPERATURES ARE HARMFUL.**
- **HIGH DAY TEMPERATURES DECREASE THE NUMBER AND WEIGHT OF SEEDS PER PLANT, SEED YIELD AND OIL CONTENT. 18-25°C IS THE OPTIMUM TEMPERATURE FOR THE CROP. ADEQUATE WARMTH AND AMPLE LIGHT ARE ESSENTIAL FOR UNIFORMITY IN GROWTH, FLORAL HEAD DEVELOPMENT, SEED FILLING AND HIGH OIL CONTENT.**
- **INCREASED ROOT TEMPERATURES GENERATE A GOOD GROWTH OF LEAVES, RESULTING IN HIGHER YIELD.**

- **HIGH RH (%) HAS MARKED POSITIVE INFLUENCE ON GROWTH OF THE CROP. THE CROP HAS A LOW TO MODERATE WATER REQUIREMENT.**
- **IT CAN MOBILIZE WATER FROM QUITE DEEP SOIL LAYERS. THE CROP WATER REQUIREMENT VARIES FROM 30-55 CM OF WATER. IT IS FAIRLY TOLERANT TO FROST.**
- **THE CROP HAS A SPECIFIC RESPONSE TO LIGHT. THE FLORAL HEAD FOLLOWS THE SUN'S PATH DURING DAY TIME AND AT SUNSET, IT FACES WEST.**
- **REDUCTION IN LIGHT INTENSITY HAS A MARKED EFFECT ON THE YIELD. DURING FLOWERING AND SEED DEVELOPMENT STAGES, REDUCED LIGHT INTENSITY HAS ADVERSE EFFECT ON THE FINAL PRODUCT.**

AVG. D.TEMP. 20-36° C  
N.TEMP. 20 -23°C,  
TOLERABLE TEMP. 19-  
40°C

OPT. TEMP.  
18 - 25°C  
HIGH RH  
CONDUSIVE

**SUNFLOWER**

FROST FLOWERING  
SPECIFIC RESPONSE  
TO LIGHT

WR : 30 TO 35CM

REDUCED LIGHT  
INTENSITY AFFECT  
CROP

# SAFFLOWER

- **IT IS WARM, TEMPERATE AND VERY DROUGHT TOLERANT PLANT GROWN IN COOL DRY SEASON.**
- **GROWTH AND YIELD OF SAFFLOWER IS LIMITED BY VERY LOW TEMPERATURES. OPTIMUM TEMPERATURE FOR ITS GROWTH IS 22-32<sup>0</sup>C, WITH 15<sup>0</sup>C AS THE OPTIMUM AND 5<sup>0</sup>C AS THE MINIMUM GERMINATION TEMPERATURE. IT IS A DAY-NEUTRAL PLANT.**
- **A WELL DISTRIBUTED RAINFALL OF 50-60 CM FROM SOWING TO HARVEST PERIOD PRODUCES GOOD YIELD. EXCESSIVE RAINFALL OR WATER-LOGGED CONDITION IS HARMFUL FOR THE CROP.**
- **FOGGY OR MISTY WEATHER DURING FLOWERING REDUCES YIELD.**
- **HEAVY IRRIGATION IN FURROW AT FLOWERING STAGE IS HIGHLY CONDUCTIVE. THE YIELD IS HIGHER WHEN GROWN IN HEAVIER SOIL WITH OPTIMUM MOISTURE SUPPLY. THE CROP GROWS WELL IN MEDIUM ALTITUDE TO THE RIVER PLAINS.**

**DROUGHT TOLERANT  
PLANT IN COOL  
SEASON**

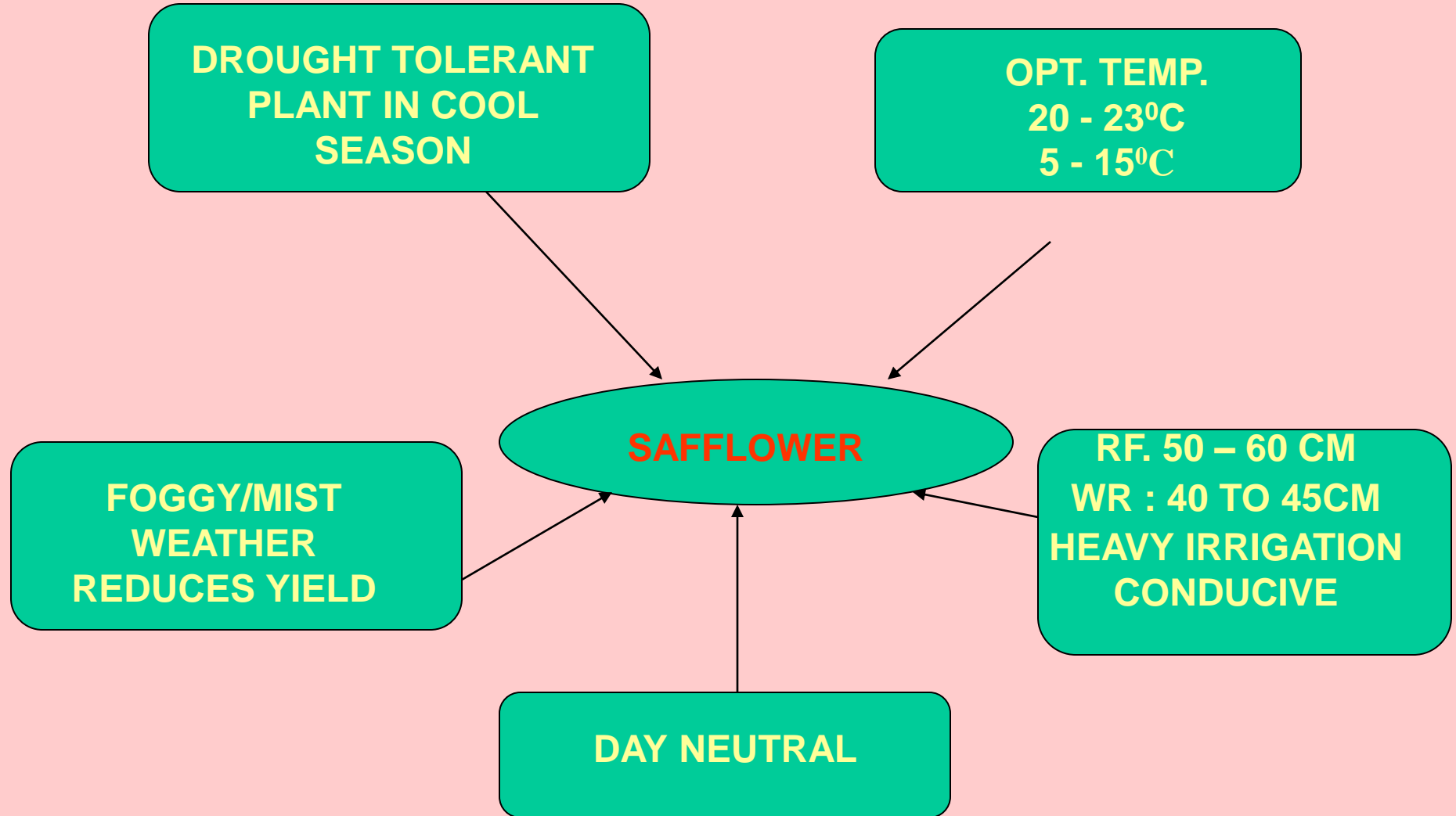
**OPT. TEMP.  
20 - 23°C  
5 - 15°C**

**FOGGY/MIST  
WEATHER  
REDUCES YIELD**

**SAFFLOWER**

**RF. 50 – 60 CM  
WR : 40 TO 45CM  
HEAVY IRRIGATION  
CONDUCTIVE**

**DAY NEUTRAL**



# TIL OR SEASAME

- **THE CROP CANNOT STAND VERY HEAVY RAINFALL, HIGH HUMIDITY AND ALSO LOW TEMPERATURE. THE MINIMUM SOIL TEMPERATURE FOR SATISFACTORY GERMINATION IS OVER 20°C.**
- **IT REQUIRES HOT TEMPERATURE FOR GROWTH (AROUND 2700 HEAT UNITS). 21-27°C TEMPERATURE IS IDEAL FOR THE CROP GROWTH. LOW TEMPERATURE AT FLOWERING GIVES POOR SEED SETTING. HIGH (ABOVE 33°C ) OR LOW (BELOW 15°C) NIGHT TEMPERATURES DELAY FLOWERING. IN TROPICAL CONDITIONS, RAINFALL HAS MORE DECISIVE INFLUENCE.**
- **PROLONGED POST-GERMINATION DRY SPELL AND CONTINUOUS RAIN DURING FLOWERING HAS A DEPRESSING EFFECT ON YIELD. ALTERNATE SPELLS OF DRY AND WET WEATHER IN PRE-FLOWERING AND FLOWERING PHASES ARE USEFUL.**
- **THE CROP ONCE ESTABLISHES CAN TOLERATE DROUGHT. GENERALLY WELL DISTRIBUTED 30-40 CM RAINFALL IS SUFFICIENT FOR ITS GOOD PRODUCTION.**



REQUIRE HOT TEMP.  
TOLERABLE TEMP. 15-33°C  
(NIGHT)  
MIN. SOIL TEMP. >20°C  
(GRM)

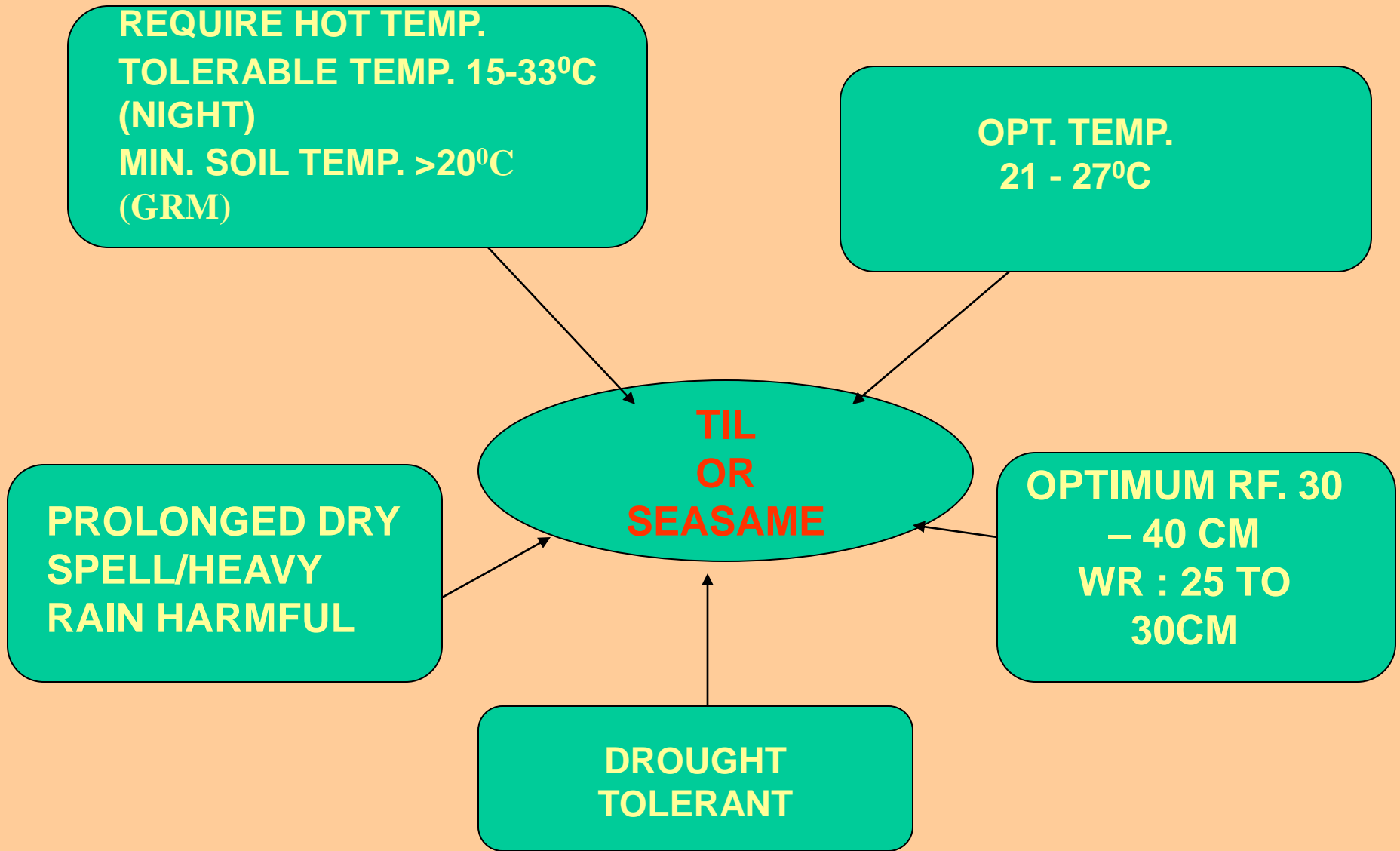
OPT. TEMP.  
21 - 27°C

PROLONGED DRY  
SPELL/HEAVY  
RAIN HARMFUL

TIL  
OR  
SEASAME

OPTIMUM RF. 30  
– 40 CM  
WR : 25 TO  
30CM

DROUGHT  
TOLERANT



# POTATO

- POTATO IS A CROP GROWN IN TEMPERATE CLIMATE.
- THE OPTIMUM PLANTING TIME TEMPERATURE NEEDS TO BE AROUND 18-20°C. TOO HIGH TEMPERATURE DAMAGES THE TUBERS AND TOO LOW TEMPERATURE DAMAGES SPROUTING.
- FOR TUBER FORMATION AND DEVELOPMENT LOWER TEMPERATURES ARE DESIRABLE. A DECREASE IN THE TUBER FORMATION AND PRODUCTION AT A CONSTANT TEMPERATURE ABOVE 25°C AND COMPLETE INHIBITION AT 29°C IS OBSERVED.

- **PLANTS ARE DAMAGED EVEN BY A MILD FROST. THE OPTIMUM SOIL TEMPERATURE FOR THE CROP VARIES FOR DIFFERENT GROWTH STAGES OF THE CROP. TEMPERATURE AND DAY-LENGTH ARE IMPORTANT FOR POTATO PRODUCTION.**
- **THE WATER REQUIREMENT OF THE CROP IS NOT VERY HIGH. FOR EARLY VARIETIES, A WELL DISTRIBUTED RAINFALL OF AROUND 40 TO 60 CM IS SUFFICIENT FOR ITS VEGETATIVE PERIOD.**
- **HEAVY RAINS, ALTERNATING WITH DRY AND WET SPELLS ARE HARMFUL. THE OPTIMUM SOIL MOISTURE FOR THE CROP IS 65-80% OF THE FIELD CAPACITY. THE CROP IS MODERATELY SENSITIVE TO SALINITY.**

**OPTIMUM PLANTING TEMP. 18 - 20°C.  
> 25°C REDUCES TUBER FORMATION  
> 29°C COMPLETE INHIBITION**

**OPT. TEMP.  
21 - 27°C  
RABI CROP**

**POTATO**

**DAMAGED BY  
MILD FROST**

**OPTIMUM RF. 40 – 60 CM  
WR : 40 TO 45 CM  
HEAVY RF. HARMFUL**

**SENSITIVE TO SALINITY  
OPTIMUM SOIL  
MOISTURE 65-80% OF  
FC.**

# ONION

- **OPTIMUM TEMPERATURE FOR GROWTH OF THE CROP IS 19-20°C.**
- **LIGHT FROST DOES NOT HAVE MUCH HARMFUL EFFECT, BUT TEMPERATURE BELOW - 3°C CAUSES CROP DAMAGE.**
- **HIGH TEMPERATURE HAMPERS CROP GROWTH. THE CROP REQUIRES HIGH AMOUNT OF WATER FOR ITS GROWTH.**
- **A DECREASE IN AIR AND SOIL HUMIDITY IS DESIRABLE DURING THE MATURITY PERIOD OF BULB.**

**OPT. TEMP 19-20°C**

**TEMP. BELOW -  
3°C HARMFUL**

**ONION**

**HIGH TEMP.  
AFFECTS CROP  
GROWTH**

**HIGH WATER  
DEMAND**

**LESS AIR & SOIL  
HUMIDITY AT  
MATURITY**

# TOMATO

- **THE CROP IS A TEMPERATE ONE. A SOIL TEMPERATURE OF 14-16<sup>0</sup>C FAVOURS GERMINATION. A DAY/NIGHT TEMPERATURE OF 26/20<sup>0</sup>C, RESPECTIVELY IS IDEAL FOR ITS VEGETATIVE GROWTH. THE GROWTH STOPS AT A TEMPERATURE BELOW 10<sup>0</sup>C.**
- **HIGH TEMPERATURE WITH LOW RH% RESULTS IN FLOWER DROPPING. TEMPERATURE AROUND 16-18<sup>0</sup>C IS IDEAL FOR ITS FRUIT SETTING AND BETTER FRUIT SIZE. THE OPTIMUM RIPENING TEMPERATURE IS 20-25<sup>0</sup>C.**
- **REQUIREMENT FOR BRIGHT SUNSHINE HOURS IS HIGH FOR THE CROP.**

SOIL TEMP. 14-16°C (GERM.)  
TEMP. 16-18°C FRUIT SETTING  
OPT. TEMP. 20-25°C (RIPENING)

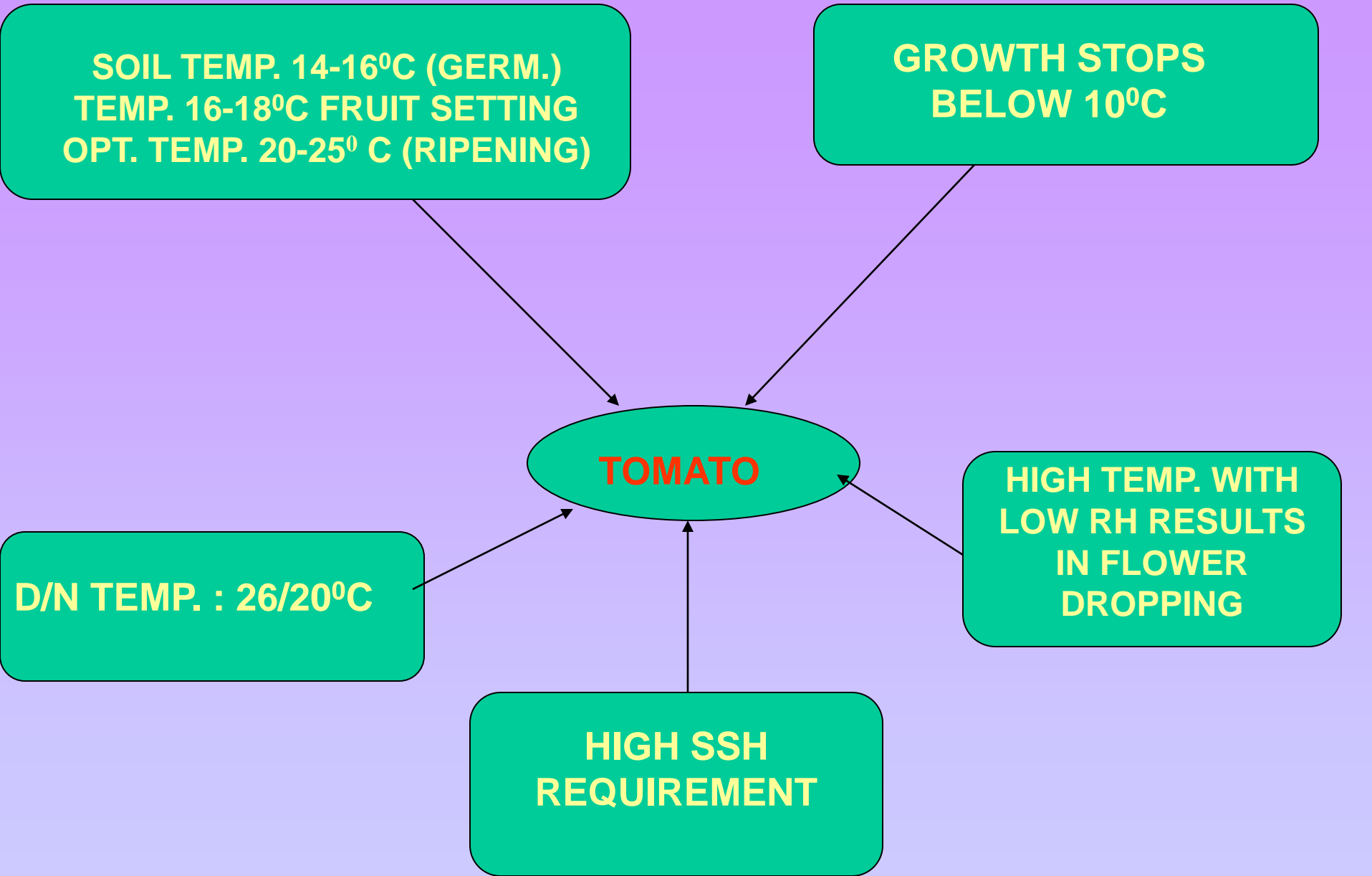
GROWTH STOPS  
BELOW 10°C

**TOMATO**

HIGH TEMP. WITH  
LOW RH RESULTS  
IN FLOWER  
DROPPING

HIGH SSH  
REQUIREMENT

D/N TEMP. : 26/20°C





# TEA

- **THE CROP REQUIRES 18-25<sup>0</sup>C AVERAGE MONTHLY TEMPERATURE, WHILE THE MINIMUM AND MAXIMUM VALUES ARE 13 AND 30<sup>0</sup>C.**
- **WARM NIGHTS LEAD TO VERY RAPID LEAF GROWTH AND RENDER THE LEAF QUALITY INFERIOR. AT LEAST 120 CM OF RAINFALL PER YEAR IS REQUIRED.**
- **ANY MONTH WITH A RAINFALL LESS THAN 5 CM IS HAZARDOUS. HAIL CAN SUPPRESS NEW LEAF PRODUCTION EVEN FOR SIX MONTHS.**
- **BRIGHT HOURS OF SUNSHINE FOR A MINIMUM 5 HOURS PERIOD IS VERY ESSENTIAL.**
- **STRONG, DRY WINDS CAN LEAD TO DEFOLIATION OF LEAVES.**

**AVRG. MONTHLY.  
TEMP. 18-25°C  
MIN. TEMP. 13°C  
MAX. TEMP. 30°C**

**WARM NIGHT FOR  
RAPID LEAF  
GROWTH**

**TEA**

**BRIGHT SSH  $\geq$  5 HRS  
CONDUCTIVE  
STRONG DRY WIND  
LEADS TO  
DEFOLIATION**

**SUSCEPTIBLE  
TO HAIL**

**ATLEAST 120CM  
RF./YEARLY  
RF. < 5 CM/MONTH  
HARMFUL**